

ANALYTICAL METHODOLOGY FOR RISK ASSESSMENT

Analytical methodology must be evaluated concurrently with factors related to sampling procedures, statistical treatment of data, and risk assessment processes to ensure that the established Data Quality Objectives (DQOs) can be attained. Responsible parties must determine the sampling methods, analytical methods, and quality control measures needed to meet the closure or remedial DQOs (for screening, determination of nature and extent, and confirmation of remediation, as applicable). These considerations must take into account the uncertainty associated with generating data and with determining that statistical criteria have been met. After the data have been generated they must be validated for conformance to quality assurance/quality control criteria, and assessed in terms of applicability to the overall project goal. In other words, data must be assessed as to whether the DQOs have been met.

Remedial Objective and the Data Quality Objective Process

The USEPA (EPA) defines DQOs and the DQO development process as follows:

What is the DQO Process? The DQO Process is a series of planning steps based on the Scientific Method that is designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate for the intended application. The steps of the DQO Process are illustrated in Figure 1 [below].

What are DQOs? DQOs are qualitative and quantitative statements derived from the outputs of each step of the DQO Process that:

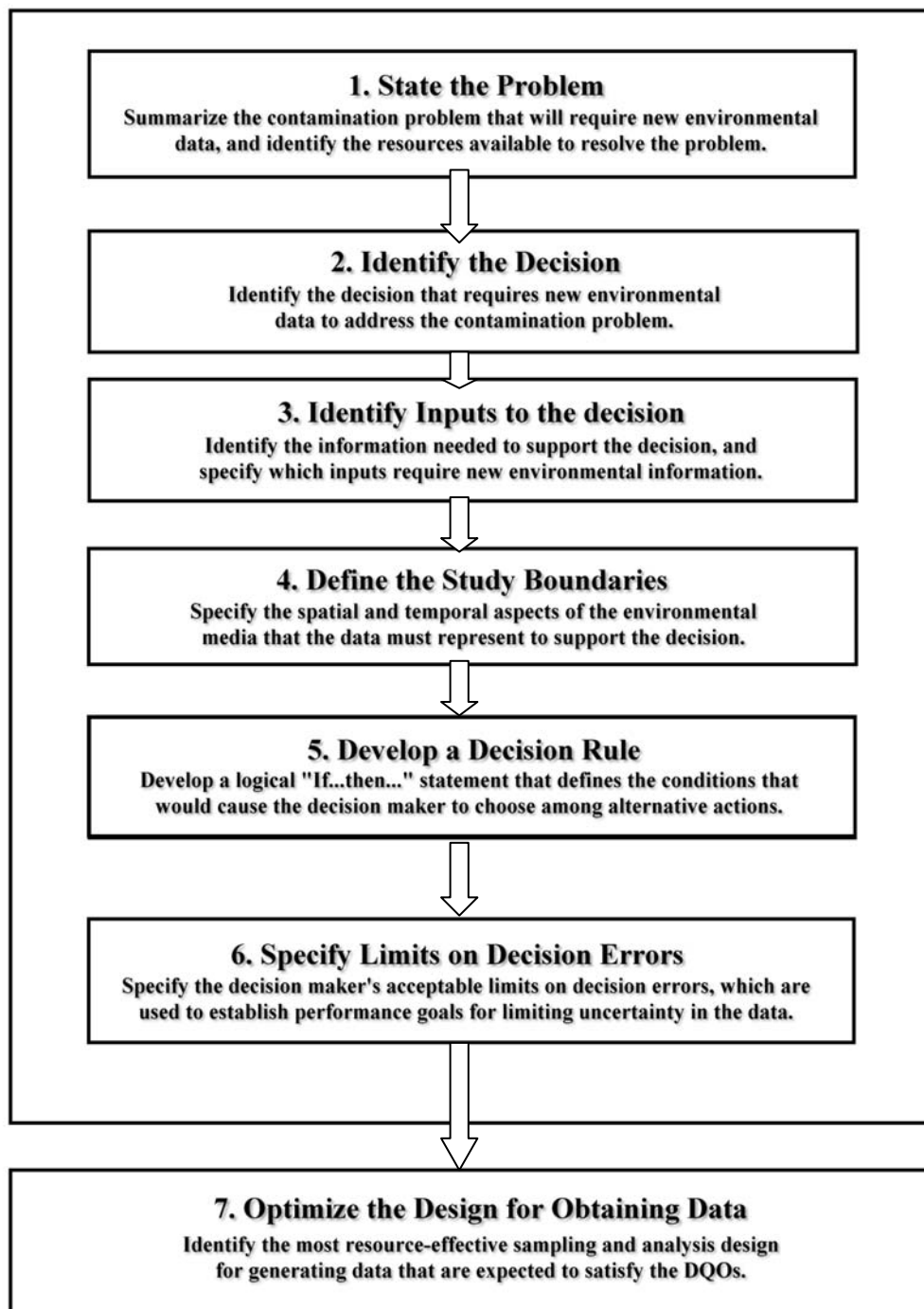
- 1) Clarify the study objective;
- 2) Define the most appropriate type of data to collect;
- 3) Determine the most appropriate conditions from which to collect the data; and
- 4) Specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the decision.

The DQOs are then used to develop a scientific and resource-effective sampling design.

The process allows decision makers to define their data requirements and acceptable levels of decision errors (decision errors occur when variability or bias in data mislead the decision maker into choosing an incorrect course of action) during planning, before any data are collected. Application of the DQO Process should result in data collection designs that will yield results of appropriate quality for defensible decision making.¹

¹Environmental Protection Agency, Office of Emergency and Remedial Response, *Data Quality Objectives Process for Superfund: Interim Final Guidance*, 9355.9-01, EPA540-R-93-071, September 1993, p. 1, NTIS, PB94-963203.

Figure 1²
The Data Quality Objective Process



²Environmental Protection Agency, Office of Emergency and Remedial Response, *Data Quality Objectives Process for Superfund: Interim Final Guidance*, 9355.9-01, EPA540-R-93-071, September 1993, p. 2, NTIS, PB94-963203.

Choosing Analytical Methods to Reduce Costs

Once the source area COCs have been determined, it is desirable to reduce costs by selecting the most cost effective analytical methods to detect and quantitate those specific COCs. However, the analytical methods selected *must* having quantitation or detection limits that can meet the required Closure Levels for the COCs in the appropriate matrices. The attached table, **Analytical Methods with Reporting Limits for RISC**, lists the COCs from the Closure Look-up Table, their respective Closure Levels for soil and groundwater matrices, and standard (promulgated) EPA analytical methods that are capable of detecting the COC at the concentration of the Closure Level. For each COC methods are included that are generally used by the RCRA (SW-846), Superfund (CLP), and Water ("Water Methods") programs unless the program has no method for that COC. **A method that does not have a quantitation limit low enough to meet the Closure Level cannot be used without adjustment or adaptation to lower the quantitation limit.** Proposed method adaptations or suggested substitute methods must be included in the QAPP. Modified or substitute methods should also be validated prior to use for an environmental project. A suggested format for method validation is presented in the IDEM manual, *Guidance to the Performance and Presentation of Analytical Chemistry Data* in the form of a checklist entitled "Performance-Based Measurement System (PBMS) Initial Demonstration of Method Performance."

Shaded boxes in the **Analytical Methods with Reporting Limits for RISC** table indicate that the methods for that program are not capable of meeting the Closure Level; the method(s) closest to meeting the Closure Level are listed. **Methods in shaded boxes should not be used unless they are adapted or modified to provide a lower quantitation limit.** Such modification or adaptation will be necessary if site COCs include bis(2-chloroethyl)ether, 2-nitroaniline, or N-nitroso-di-n-propylamine. There are no promulgated EPA methods that can currently meet the human health Closure Level for these analytes in one or both matrices.

Adapted, modified or alternate methods may also be required when the site affects an ecologically susceptible area. When an ecological risk assessment is required, alternate ecological protection levels must be used that often are lower than the human health Closure Levels. **If alternate ecological protection levels cannot be met by unmodified methods, analytical methods must be adapted or modified, or alternate analytical methods must be found, to reach the lower ecological protection levels.** This is true for ecological risk assessments even if the unmodified method does meet the human health Closure Level. Proposed method modifications or alternate methods must be included in the QAPP and should be validated prior to use for the ecological risk assessment using a format similar to the "Performance-Based Measurement System (PBMS) Initial Demonstration of Method Performance Checklist" suggested in the IDEM manual, *Guidance to the Performance and Presentation of Analytical Chemistry Data*.

To minimize analytical costs yet achieve quantitation limits below the risk-based Closure Levels, it may be necessary to select analytical methodology different than the methods that are most familiar to environmental project managers. For example, many environmental professionals are accustomed to using the SW-846 gas chromatography/mass spectrometry (GC/MS) Methods 8260 for volatile organic compounds (VOCs) and 8270 for semivolatile organic compounds

(SVOCs). However, standard GC/MS procedures usually have higher EQLs than GC using detectors other than MS, meaning that the GC/MS quantitation limits may not meet the required Closure Levels. Another chromatography technique used to analyze semivolatile and nonvolatile organic compounds, high performance liquid chromatography (HPLC), also tends to have lower EQLs than GC/MS methods and may be preferred for some analytes (COCs). In addition, GC/MS methods may be more expensive than GC or HPLC. This is because the larger number of analytes typically targeted in standard GC/MS methods can increase calibration and quality control sample costs. (Note: Limiting the number of analytes by telling your laboratory contact, prior to analysis, the exact COC list you must report, might reduce the analysis cost. If you merely request a certain method, the laboratory will analyze for the full list of analytes published in the method.)

In contrast, HPLC methods or GC methods employing detection techniques such as photoionization (PID) or electron capture (ECD) may be preferable when the site-specific chemicals of concern (COCs) are few in number and well known (so as to reduce cost), or when lower detection limits are needed to meet risk-based Closure Levels. These GC and HPLC methods group analytes by *individual (or closely related) chemical class*. They cannot group diverse chemical classes into one analysis (like GC/MS).

To minimize costs, the project manager should consult the laboratory chemist to determine the best analysis or suite of analyses to meet the project DQOs for the site-specific COCs identified in the QAPP.

Consider the following objectives for a petroleum release site:

- Identify Hazardous Substances and Media

A default risk assessment will be performed for a petroleum-release site where diesel fuel was stored. No non-petroleum chemicals were ever used at the site, and diesel fuel is a high-end liquid hydrocarbon fuel, so the site-specific COCs are the class B2-carcinogenic polynuclear aromatic hydrocarbons (cPAHs), **Naphthalene**, and BTEX. Per the QAPP, sampling will be performed on subsurface soils and groundwater, and concentrations will be compared to residential Closure Levels.

- Identify Chemicals of Concern (COCs)

The cPAH group (a subset of the larger class of chemicals, SVOCs) consists of the following compounds: benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene. All of these compounds are on the analyte list for Method 8270C, but they also appear on the compound list for Method 8310, a high performance liquid chromatography (HPLC) technique specifically for polynuclear aromatic hydrocarbons. Benzene, toluene, ethyl benzene, and xylene (BTEX) are volatile organic compounds appearing on the Method 8260B compound list. The BTEX compounds are also listed for Method 8021B, “Aromatic and Halogenated Volatiles by Gas Chromatography.” Which methods should be used?

• Identify Analytical Methods

First, the Closure Levels for the COCs in subsurface soil and groundwater should be compared to the estimated quantitation limits (EQLs) for the COCs in the applicable methods. The following table compares the default residential Closure Levels for the COCs in our example to the EQLs for Methods 8260B and 8021B (BTEX) and Methods 8270C and 8310 (cPAHs):

Residential Closure Level/EQL Comparison Table (Petroleum)

BTEX						
Compound	SS Soil Closure Level, µg/kg	8260B EQL, soils, µg/kg	8021B EQL, soils, µg/kg	GW Closure Level, µg/L	8260B EQL, µg/L (purge: 5 mL/25 mL)	8021B EQL, aqueous, µg/L
Benzene	33.8	5	0.09	5.	5*/ 1	0.09
Toluene	11,700.	5	0.10	1,000.	5 / 1	0.10
Ethyl benzene	13,400.	5	0.05	700.	5 / 1	0.05
Xylene	200,000.	5	0.20	10,000.	5 / 1	0.20
cPAHs						
Benzo[a]anthracene	4,620	660	8.78	1.17	10	0.13
Benzo[a]pyrene	462	660	16	0.2	10	0.2
Benzo[b]fluoranthene	4,620	660	12	1.17	10	0.18
Benzo[k]fluoranthene	39,400	660	12	0.8	10	0.17
Chrysene	25,500	660	100	1.6	10	1.5
Dibenzo[a,h]anthracene	462	660	20	0.12	10	(MDL) 0.03*
Indeno[1,2,3-cd]pyrene	3,050	660	30	0.022	10	(MDL) 0.04**

*Special care required.

**Method adaptation and special care required.

The first inclination of the project manager may be to ask the laboratory to run Methods 8260 and 8270. Looking at the table, we can see the following: The BTEX section indicates that Method 8260 EQLs are sufficiently low to meet the BTEX Closure Levels for both sub-surface soil and ground water. Next the project manager calls the laboratory to obtain pricing for Method 8260 and BTEX by Method 8021. Prices are quoted at \$200 for the standard 8260 analyte list and \$80 for BTEX by 8021.

The laboratory contact also informs the project manager that to run BTEX compounds alone by 8260 would cost \$85-\$90. The chemist explains that this is because the benzene analysis by 8260 will require special attention: The laboratory normally purges a 5 mL sample, yielding a 5 µg/L EQL for Method 8260 analytes. The benzene Closure Level (based on the

MCL) is also 5 µg/L. An EQL equal to but no lower than the Closure Level leaves no room for uncertainty, such as matrix interference or random variability. To minimize the possibility of false positive or false negative results, it would be advisable to purge 25 mL sample for the benzene analysis, so that an EQL of 1 µg/L would be obtained. The project manager considers the information supplied by the laboratory chemist and decides on Method 8021, both to save money and to ensure adequate detection levels for benzene.

Next, looking at the cPAH section, we can see that Method 8270 is not suitable for the default risk assessment because EQLs exceed the Closure Levels for all COCs in groundwater and two COCs in subsurface soil (Dibenzo[a,h]anthracene and indeno[1,2,3-cd]pyrene). The project manager requests the laboratory to run Method 8310 for cPAHs, explaining the detection limits that are needed to meet the Closure Levels. The laboratory contact may explain that additional charges will be incurred to adapt the method to lower detection limits for Dibenzo[a,h]anthracene and indeno[1,2,3-cd]pyrene in ground water or suggest an alternate method, if one is available.

Similar reasoning can be applied to objectives for a chemical release site. For example:

- Identify Hazardous Substances and Media

A default risk assessment will be performed for a chemical-release site where paint and varnish waste was processed. A variety of solvents and paint removers were also used at the site. Some of the paints contained inorganic pigments. Sampling will be performed on surface and subsurface soils, and concentrations will be compared to *non*-residential Closure Levels.

- Identify Chemicals of Concern (COCs)

Based on previous sampling, MSDS sheets, and other records, the COCs were determined to be: (1) solvents (used independently and as paint and paint remover components): n-butanol, methyl ethyl ketone (MEK), benzene, toluene, methylene chloride; and (2) metals (from inorganic pigments): titanium, copper, and chromium. The following table compares the default Non-residential Closure Levels for the COCs in this example to the EQLs for SW-846 methods appropriate for the analysis of solvents and metals.

- Identify Analytical Methods

First, the Closure Levels for the COCs in subsurface soil and groundwater should be compared to the estimated quantitation limits (EQLs) for the COCs in the applicable methods. The solvents are all on the 8260 list. Benzene, toluene, and methylene chloride can also be run by Method 8021B, but not by 8015B. MEK and n-butanol can be run by Method 8015B but not by 8021B. The EQLs for all these volatile organic compounds in each appropriate method are lower than the Closure Levels. The project manager may choose to run all these volatile organic compounds by 8260 or may choose to combine methods 8015B and 8021B; the choice depends on which has the lower cost.

Chromium, copper, and titanium are all on the analyte list for Method 6010B, Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP). Copper and chromium can also be run by Atomic Absorption Spectroscopy (AA) methods; there is no AA method for

titanium. Either method choice is sufficient to meet the Closure Levels for chromium. Copper and titanium do not have Closure Levels. However, analyses will be run to measure site concentrations, and site-specific Closure Levels will be calculated. All three metals may be run by ICP, or the project manager may choose AA for copper and chromium, depending on which analysis costs least.

Non-Residential Closure Level/EQL Comparison Table (Paint Chemicals)

Solvents							
Compound	SS Closure Level, µg/kg	Surface Closure Level, µg/kg	8260B EQL, soils, µg/kg	8021B EQL, soils, µg/kg	GW Closure Level, µg/L	8260B EQL, µg/L	8021B EQL, µg/L
<i>Benzene</i>	668	13,000	5	0.09	98.7	5	0.09
<i>Toluene</i>	240,000	654,000	5	0.10	20,400	5	0.10
<i>Methylene chloride</i>	1,770	197,000	5	0.05	382	5	0.05
Compound	SS Closure Level	Surface Closure Level	8260B	8015B	GW Closure Level	8260B	8015B
<i>Butanol</i>	43,700	1,000,000	100	2300	10,200	100	70
<i>MEK</i>	279,000	1,000,000	100	2700	61,300	100	50
Metals							
Compound	SS Closure Level	Surf Closure Level	6010(ICP)	AA method	GW Closure Level	6010(ICP)	AA method
<i>Chromium</i>	196,000	1,000,000	1000	1000	511	10	50
<i>Copper</i>	none	none	1000	1000	none	20	20
<i>Titanium</i>	none	none	5000	none	none	50	none

Sampling Design and Quality Assurance/Quality Control

Sampling design and sampling field procedures must be supportive of the project DQOs. A Sampling and Analysis Plan (SAP) should be prepared as part of the QAPP. Accurate field notes should be taken. Sampling methods from source documents published by the USEPA, American Society for Testing and Materials (ASTM), U.S. Department of the Interior, National Ground-water Association (NGWA), American Petroleum Institute (API), or other recognized organizations with appropriate expertise should be used, if possible. Field quality control procedures and collection of field quality control samples are necessary to ensure that the precision and accuracy of the measured COC concentrations can be determined. In general the following field QA/QC measures will be required:

- Chain-of-custody
- Trip blank (for volatile organics compounds, one for each day of sampling)
- Field blank
- Equipment blank (rinsate blank)

- Field duplicates (a minimum of one duplicate for every 20 or fewer samples)
- Documentation of field events (sampling procedures, locations, conditions, and characteristics of samples collected)

Appropriate sample containers; preservatives; and handling, storage, and transportation techniques should also be used to maintain the integrity of the samples and analytical data. The control criteria that the field QA/QC measures should meet can be found in the IDEM manual, ***Guidance to the Performance and Presentation of Analytical Chemistry Data***. **The field QA/QC measures must be documented and should be submitted as supporting documentation to the risk assessment along with the analytical results.**

Analytical Quality Assurance/Quality Control

The QA/QC procedures described in the analytical method chosen should be followed to ensure that Closure Level criteria and other project DQOs can be met. In general, the following measures will be required:

- Chain-of-custody
- Holding time requirements
- Instrument tuning
- Instrument calibration records
- Initial and continuing calibration verifications
- Laboratory control samples
- Matrix spike/matrix spike duplicate samples
- Raw data

The control criteria that the analytical QA/QC measures should meet can be found in the IDEM manual, ***Guidance to the Performance and Presentation of Analytical Chemistry***. **The laboratory QA/QC measures and their results must be documented and should be submitted as supporting documentation to the risk assessment along with the analytical report of sample results.**

Documentation Requirements

Documentation requirements for analytical data, field QA/QC measures, and laboratory QA/QC results are listed below. General requirements applicable to all samples are followed by requirements specific to analysis type.

GENERAL Sampling Quality Control Data and Information:

- Chain-of-Custody
- Date and time each sample was taken
- Map or diagram indicating sample locations
- Field measurements made (and results)
- Any notable observations (color, clarity, texture, reaction with preservatives, etc.)

- Trip blank (or field blank)
- Equipment blank (rinse blank)
- Identity of field duplicates (a minimum of one duplicate for every 20 or fewer samples)

GENERAL Laboratory Quality Control Data and Information:

- Completed Chain-of-Custody
- Date and time of receipt at the laboratory
- Condition of samples upon receipt at the laboratory
- Sample identification number or designation
- Laboratory sample numbers corresponding to facility sample identification
- Sample preparation, extraction, cleanup, or digestion method(s) and date(s)
- Analytical method (name, number, and source) and date of analysis
- Final analytical results
- Case narrative (Includes deviations from standard analytical or preparatory procedure(s); quality control problems encountered--whether stemming from system, instrumentation, analyst error, or sample matrix; corrective measures taken; if corrective measures as called for in the method were not taken; results of corrective measures taken; etc.)

SPECIFIC ANALYSES

Metals and General Inorganic Analyses

TOTAL AND DISSOLVED METALS by Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP) or Atomic Absorption Spectroscopy (AA) and GENERAL INORGANIC ANALYSES

- Method/sample quantitation limits
- Instrument detection limits
- Calibration records and results:
- Blank results
- Matrix spike (sample number of sample spiked, sample concentration for analyte, concentration of spike added, results and % Recovery)
- Matrix spike duplicate or laboratory duplicate (results and Relative Percent Difference [RPD]; if matrix spike duplicate, also report %Recovery)
- Laboratory control sample (QC standard or lab-fortified blank: results and %Recovery)
- Additional deliverables for ICP analysis (if applicable): Interference check sample (results and % recovery), serial dilution results (five-fold analysis), ICP Linear Range, and inter-element correction factors
- Method of Standard Addition (MSA) results (if applicable)
- **Raw data:** To include instrument numerical printouts, instrument peak printouts (all AA and general inorganic, where applicable), lab worksheets, strip chart recordings, sample preparation records, and record of dilutions.

Organic Analyses

VOLATILE ORGANIC ANALYSIS (VOA) and SEMIVOLATILE ORGANIC ANALYSIS (SVOA)
BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

- Tuning criteria and results
- Initial calibration data and results
- Initial and Continuing Calibration Verification data and results (beginning of run and every twelve hours:
- Method blank summary sheet with results, including detections
- Detection/quantitation limit for each compound
- Internal standards summary
- Surrogate (System Monitoring Compound) results (concentration of surrogate spikes added, measured concentrations, and % Recoveries of all surrogates) for each sample
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) results (sample concentration for analyte, concentration of spike added, results, % Recovery for each compound, and Relative Percent Difference between MS and MSD for each compound)
- **Raw Data** for each sample, field duplicate, blank, matrix spike/matrix spike duplicate.

ANALYSIS OF VOLATILE ORGANIC COMPOUNDS and SEMIVOLATILE ORGANIC COMPOUNDS BY GAS CHROMATOGRAPHY (GC) Using Method-Specified Detectors (FID, PID, HECD, etc.)

- Initial Calibration, data and results
- Retention Time (RT) Summary to include:
 - RT measured for each target compound from three separate injections over a 72-hour period
 - Mean and standard deviations of the three RTs measured (over the 72-hour period)
 - RT window for each target compound (mean \pm three standard deviations)
 - Date and time of injections (or introduction by purge-and-trap)
- Initial and Continuing Calibration Verification (ICV and CCV)
- Method of sample introduction (direct injection or purge-and-trap)
- Detection/quantitation limit for each compound
- Method blank summary and chromatograms
- Surrogate recoveries for samples, blanks, and spikes
- Matrix spike/matrix spike duplicate (MS/MSD) analysis or lab duplicates
- **Raw Data** for each sample, standard, field duplicate, blank, matrix spike, and matrix spike duplicate, including dilutions made, chromatograms and preparatory records.
- Confirmation by GC/MS or on second GC column, if required by determinative method or if interference is suspected. Include results and raw data.

QUALITY ASSURANCE/QUALITY CONTROL INFORMATION FOR ANALYSIS OF PESTICIDES and PCBs BY GAS CHROMATOGRAPHY (GC) WITH ELECTRON CAPTURE DETECTOR (ECD) OR ELECTROLYTIC CONDUCTIVITY DETECTOR (ELCD OR HECD)

- Initial Calibration
- Method blank summary and chromatograms
- Detection/quantitation limit for each compound (in each sample)
- Surrogate recoveries for samples, blanks, and spikes
- Matrix spike/matrix spike duplicate (MS/MSD) analysis or laboratory duplicates
- **Raw Data** for each sample, standard, field duplicate, blank, matrix spike, and matrix spike duplicate, including dilutions made, preparatory records, and chromatograms

- Confirmation of detection **required**: on second GC column *OR* by GC/MS with supporting documentation

Data Validation

Validation is the evaluation of the technical usability of the data in light of its intended use: whether the methods used and results obtained make sense and are scientifically defensible given the study objectives. This is done through a "PARCC" evaluation: **precision, accuracy, representativeness, completeness, and comparability**.

- **Precision** is the measurement of agreement of a set of replicate results among themselves without assumption of any prior information as to the true result. Precision is assessed through the analysis or duplicate or replicate samples.
- **Accuracy** is the nearness of a result or the nearness of the mean of a set of results to the true value. Accuracy is assessed through the analysis of reference samples or the introduction of reference materials to field samples and measurement of percent recovery of the known value.
- **Representativeness** is an assessment as to how well the field samples collected reflect the actual site conditions.
- **Completeness** is an assessment as to whether sufficient information has been provided. It includes aspects from whether a sufficient number of samples were collected to whether enough analytical documentation of laboratory operations was provided.
- **Comparability** is how well the data corresponds to data collected in previous sampling events at the site or to site samples from the same event analyzed at different laboratories.

The PARCC evaluation is accomplished through a comprehensive QA/QC review of the data, providing an estimate of the uncertainty in the data values. Guidelines for performing a comprehensive data review are listed below.

Data Review Guidelines

The criteria listed in the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*³ and the *USEPA Contract Laboratory Program Guidelines for Inorganic Data Review*⁴ 9240.1-05-01, EPA-540/R-94-013, February 1994, NTIS: PB94-963502 provide a good starting point for data review. **However, an unmodified "CLP review" is not sufficient for validating data to be used in support of risk assessments.** A "CLP review" results in data that are flagged by "data qualifiers," that is, letter symbols denoting a general category of data quality, such as "estimated" (J) or "unusable" (R). These qualifiers do not explain the scientific evidence in the data leading to the qualification and do not provide a

³Environmental Protection Agency, Office of Solid Waste and Emergency Response, Publication 9240.1-05, EPA-540/R-94/012, February 1993, NTIS: PB94-963501.

⁴Environmental Protection Agency, Office of Solid Waste and Emergency Response, Publication 9240.1-05-01, EPA-540/R-94-013, February 1994, NTIS: PB94-963502

measurement or estimate of the uncertainty in the data values, and thereby, their application to the Closure Level values.

Data validation for risk assessment involves reviewing the data using criteria similar to those listed in the CLP *National Functional Guidelines* but going on to document the evidence for qualification and measure or estimate the statistical error or uncertainty. The following is a suggested review process. It can be applied to any type of analytical method used:

1. Review every criterion listed in the *National Functional Guidelines* for the applicable QC measure and use the evaluation procedure listed, with these exceptions:

- a. Substitute the control limits/criteria specified in the actual analytical method followed for the CLP limits in the *National Functional Guidelines*. If the actual method followed does not specify set control limits, use the CLP control limits.
- b. After evaluating all applicable criteria for the analysis type, qualify the data if appropriate. To do this, rather than just adding a CLP qualifier (like “J” or “R”) to the reported result, write a memo or report explaining in words why the data is estimated or unusable:
 - Go into detail in the text of the review report, listing all criteria or reasons justifying the qualification as estimated or unusable. Explain whether it is a sample matrix problem, a laboratory precision or accuracy problem, a sampling problem, etc.
 - Do this separately for each analyte. However, groups of analytes of the same general class (e.g., “metals” or “semivolatile organics”) that have the exact same QC problems for the exact same samples or monitoring wells can be grouped together.
 - If the QC problem affects analysis of *all* samples for that analyte, say so and qualify all. If the problem can be identified as being limited to particular samples, list which samples they are (and do not qualify the others).
 - Provide an abbreviated summary of the reasons in a “Table of Estimated Analytes” to be included at the end of the report.
- c. In the case of accuracy problems, assign a direction of bias where possible. If possible, also attempt to quantify the bias as a percentage or number of measurement units.
- d. In the case of precision problems, state that it is a precision problem in some way—e.g.: “the duplicates compare (or do not compare) well,” “results exhibit high variability,” “results exhibit poor repeatability,” etc.—and that the direction of bias cannot be determined. Again, when possible, estimate the uncertainty expressed as a range: +/- a percentage value or +/- some number of measurement units.

2. Review 100% of the raw data and base your findings mainly on the raw data.

- X Do not rely solely on the certificates of analysis (or “analytical reports”), QA reports, and “Case Narratives” for your determinations. These can be incomplete or include errors.
 - X Check calculations.
 - X Look for trends—in matrix effects, blank results, calibration check samples, etc., and use these to help you evaluate the data.
- 3. Always keep in mind the question the data is supposed to answer and the objective of the review.** Data submitted for an environmental project is not reviewed in the same way as a data intended to determine a laboratory’s conformance to contract requirements. What we are looking for in the data validation is the answer to these questions: Is the quality of the data sufficient to meet the project objectives? What does the data tell us about the site? What relationship does this data have to the exposure assumptions?

The data validation process supports the subsequent Data Quality Assessment activities.

Data Quality Assessment Process (DQA)

Data Quality Assessment is the scientific and statistical process that determines whether environmental data are of the right type, quality, and quantity to support project decisions. DQA is built on a fundamental premise: data **quality**, as a concept, is meaningful only when it relates to the intended use of the data. *“Data quality does not exist without some frame of reference. The context in which the data will be used in order to establish a yardstick for judging whether or not the data set is adequate.”*⁵ **The DQA tells us if the data has answered the questions the project was intended to ask about the site.**

Definitions of Words and Acronyms appearing in the Analytical Methods with Reporting Limits for RISC Table:

Analyte	The substance (element or compound) being identified and measured in the sample. It may be a suspected contaminant, contaminant of concern, or natural background component.
CAS No.	<p>Chemical Abstract Service (CAS) registry number. A unique numerical identifier that specifies a particular substance no matter what chemical name or synonym is used.</p> <p>E.g.: *79-01-6 = Trichloroethene = Trichloroethylene = “Tricloran” = “TCE”</p> <p>*71-55-6 = 1,1,1-Trichloroethane = Methyl chloroform = “Chlorothene” = “TCA”</p> <p><i>“TCE” and “TCA” are not the same compound.</i></p>

⁵Environmental Protection Agency, Office of Research and Development, *The EPA Quality System*, EPA QA/G-0 Final, August 1997, p. 9-1.

Quantitation

Limit (QL) The lowest concentration that can be *reliably* achieved within specified limits of precision and accuracy during routine laboratory operating conditions. Individual sample QLs are highly matrix dependent and may vary widely.

Method Reporting Limit The QL reported by the referenced methods manual for a specific substance analyzed by a specific method.

µg/kg Micrograms per kilogram. An expression of concentration as mass of analyte per unit mass of sample in “parts per billion.” Used for soil, sediment, and waste samples.

µg/L Micrograms per liter. An expression of concentration as mass of analyte per unit volume of sample in “parts per billion.” Used for aqueous samples.

Types of Method Reporting Limits referenced in this document and the Table:

XEQL *Estimated Quantitation Limit.* Specified in many SW-846 methods. Often set at 10 times the MDL or at the concentration of the lowest non-zero standard in the calibration curve. Use of the word “estimated” emphasizes matrix dependence: variation between samples will occur, and the EQL may not always be achievable.

XCR(Q/D)L *Contract Required Quantitation Limit (CRQL) or Contract Required Detection Limit (CRDL),* as applicable. Used in the CLP Statements of Work. **CRDL:** Used for inorganic analytes; **CRQL:** Used for organic compounds.

XMDL *Method Detection Limit.* Minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Used in Drinking Water methods and some SW-846 methods. Often not achievable in routine analysis of field samples other than low concentration water samples.

References

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RESIDENTIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC (September 15, 2000)

RESIDENTIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC (September 15, 2000)													
Analyte	CAS No.	RESIDENTIAL SOIL (µg/kg)						RESIDENTIAL GROUND WATER (µg/L)					
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQL	Method	CR(Q/D)L	Method		EQL	Method	CR(Q/D)L	Method	MDL	Method
Acenaphthene	83-32-9	130,000	660 18000	8270C 8310 ^N	330	OLM04.2-D/SVOA	460	10 18	8270C 8310	10	OLM04.2-D/SVOA	1.8 1.9	610 ⁷ 625 ⁷
Acetone <i>synonym: 2-Propanone</i>	67-64-1	3,100	50 160	8260B ^{K,R} 8015B ^N	10	OLM04.2-D/VOA	770	5 160	8260B 8015B ^N	10	OLM04.2-D/VOA	—	—
Acrolein <i>synonym: 2-Propenal</i>	107-02-8	0.23*	5	8260B ^E	—	---	0.055*	1	8260B ^D	—	—	0.7	603 ⁷
Aldrin	309-00-2	250	23	8081B ^{E,M}	1.7	OLM04.2-D/PEST	0.050	0.034	8081B ^F	0.050	OLM04.2-D/PEST	0.007 0.045	505 ⁴ 525.2 ⁴
Anthracene	120-12-7	51,000	660 6600	8270C 8310 ^N	330	OLM04.2-D/SVOA	43	10 6.6	8270C 8310	10	OLM04.2-D/VOA	0.18	525.2 ⁴
Antimony	7440-36-0	5,400	2100 200	6010B ^G 6020A ^{1b,G}	3200 ^C	ILM04.0/200.7 CLP-M	6.0	3 0.4	7041 (7010 ^{1b}) 6020 ^G	3	ILM04.0/ 204.2 CLP-M (<i>furnace</i>)	3 0.4	204.2 ⁵ 200.8 ⁵
Arsenic	7440-38-2	3,900	3500 600	6010B ^G 6020A ^{1b,G}	500 ^C	ILM04.0/ 206.2 CLP-M (<i>furnace</i>)	5.0 ^J	1 1.4	7060A(7010 ^{1b}) 6020 ^G	1	ILM04.0/ 206.2 CLP-M (<i>furnace</i>)	1 1.4	206.2 ⁵ 200.8 ⁵
Barium	7440-39-3	1,600,000	100 400	6010B ^G 6020A ^{1b,G}	20000 ^C	ILM04.0/200.7 CLP-M	2,000	1 0.8	6010B ^G 6020 ^G	200	ILM04.0/200.7 CLP-M	1 0.8	200.7 ⁵ 200.8 ⁵
Benz[a]anthracene	56-55-3	5,000	660 130	8270C 8310 ^N	330	OLM04.2-D/SVOA	1.2	0.13	8310	10	OLM04.2-D/SVOA	0.20	525.2 ⁴
Benzene	71-43-2	34	0.09 5	8021B ^{E,N} 8260B ^E	10	OLM04.2-D/VOA	5.0	0.09 1	8021B ^N 8260B ^D	10	OLM04.2-D/VOA	0.02 0.04	502.2 ⁴ 524.2 ⁴
Benzo[b]fluoranthene	205-99-2	5,000	660 180	8270C ^E 8310 ^N	330	OLM04.2-D/SVOA	1.2	0.18	8310	10	OLM04.2-D/SVOA	0.3	525.2 ⁴
Benzo[k]fluoranthene	207-08-9	39,000	660 170	8270C 8310 ^N	330	OLM04.2-D/SVOA	0.80	0.17	8310	10	OLM04.2-D/SVOA	0.3	525.2 ⁴
Benzoic acid	65-85-0	590,000	3300	8270C ^V	—	—	150,000	50	8270C ^V	—	—	50 ^H	1625C ⁸
Benzo[a]pyrene	50-32-8	500	230	8310 ^N	330	OLM04.2-D/SVOA	0.20	0.02	8310 ^F	10	OLM04.2-D/SVOA	0.1	525.2 ⁴
Benzyl alcohol	100-51-6	48,000	1300	8270C ^V	—	—	11,000	20	8270C ^V	—	—	50 ^H	1625C ⁸
Beryllium	7440-41-7	63,000	100 100	6010B ^G 6020A ^{1b,G}	500 ^C	ILM04.0/200.7 CLP-M	4.0	0.3 0.3	6010B 6020A ^{1b,G}	0.2	ILM04.0/ 210.2 CLP-M (<i>furnace</i>)	0.7 0.3	200.7 ⁵ 200.8 ⁵

RESIDENTIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC (September 15, 2000)

Analyte	CAS No.	RESIDENTIAL SOIL (µg/kg)					RESIDENTIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQL	Method	CR(Q/D)L	Method		EQL	Method	CR(Q/D)L	Method	MDL	Method
Bis(2-chloroethyl)ether <i>syn: 1,1'-Oxybis(2-chloroethane)</i>	111-44-4	0.70	0.5	8410 ^{E,L}	330	OLM04.2-D/SVOA	0.15*	0.3	8111 ^{F,I,X}	10	OLM04.2-D/SVOA	0.3	611 ^{7,X}
Bis(2-chloroisopropyl)ether <i>syn: 2,2'-Oxybis(1-chloropropane)</i>	108-60-1	27	0.5	8410 ^{E,L}	330	OLM04.2-D/SVOA	4.2	0.8	8111 ^{F,I}	10	OLM04.2-D/SVOA	0.8	611 ⁷
Bis(2-ethylhexyl)phthalate <i>syn.: Di(2-ethylhexyl)phthalate</i>	117-81-7	300,000	625 2700	8270C 8061A ^{N,R}	330	OLM04.2-D/SVOA	6.0	2.7	8061A ^N	10	OLM04.2-D/SVOA	0.8	525.2 ⁴
Bromodichloromethane	75-27-4	630	5 25	8260B ^E 8021B ^N	10	OLM04.2-D/VOA	100	5 0.2	8260B 8021B ^N	10	OLM04.2-D/VOA	0.02 0.08	502.2 ⁴ 524.2 ⁴
Bromoform <i>synonym: Tribromomethane</i>	75-25-2	750	5 16	8260B ^E 8021B ^{E,N}	10	OLM04.2-D/VOA	100	5 1.6	8260B 8021B ^N	10	OLM04.2-D/VOA	1.6 0.12	502.2 ⁴ 524.2 ⁴
n-Butanol <i>syn.: n-butyl alcohol, 1-butanol</i>	71-36-3	16,000	625 2300	8260B ^{R,U} 8015B ^{Q,U}	---	---	3,700	5 140	8260B ^U 8015B ^U	---	---	500	1666 ¹²
Butyl benzyl phthalate	85-68-7	930,000	660	8270C ^R	330	OLM04.2-D/SVOA	2,700	10	8270C	10	OLM04.2-D/SVOA	0.5	525.2 ⁴
Cadmium	7440-43-9	7,500	300 200	6010B ^G 6020A ^{Ib,G}	500 ^C	ILM04.0/200.7 CLP-M	5.0	0.1 5	7131A 6020	5	ILM04.0/200.7 CLP-M	1 0.5	200.7 ⁵ 200.8 ⁵
Carbazole	86-74-8	5,900	[660 [1000	8270C] ^W 8275A] ^{P,W}	330	OLM04.2-D/SVOA	43	[10 [10	8270C] 8270C]	330	OLM04.2-D/SVOA	20	1625C ⁸
Carbon disulfide	75-15-0	10,000	50	8260B ^K	10	OLM04.2-D/VOA	1,300	5	8260B	10	OLM04.2-D/VOA	0.09	524.2 ⁴
Carbon tetrachloride	56-23-5	66	5 13	8260B ^E 8021B ^N	10	OLM04.2-D/VOA	5.0	1 0.1	8260B ^D 8021B ^N	10	OLM04.2-D/VOA	0.01 0.21	502.2 ⁴ 524.2 ⁴
Chlordane	57-74-9	9,600	370 (()	8081B ^{M,R}	1.7	OLM04.2-D/PEST	2.0	0.37(()	8081B ^M	0.05	OLM04.2-D/PEST	0.0015	508 ⁴
p-Chloroaniline <i>synonym: 4-Chloroaniline</i>	106-47-8	970	440 1300	8131 ^{E,N} 8270C ^{E,V}	330	OLM04.2-D/SVOA	150	46 20	8131 8270C	10	OLM04.2-D/SVOA	20	1625C ⁸
Chlorobenzene	108-90-7	1,300	13 625	8021B ^{N,R} 8260B ^N	10	OLM04.2-D/VOA	100	0.1 5	8021B ^N 8260B	10	OLM04.2-D/VOA	0.01 0.04	502.2 ⁴ 524.2 ⁴

RESIDENTIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC (September 15, 2000)

Analyte	CAS No.	RESIDENTIAL SOIL (µg/kg)					RESIDENTIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQL	Method	CR(Q/D)L	Method		EQL	Method	CR(Q/D)L	Method	MDL	Method
Chloroethane	75-00-3	260	1	8021B ^{E,N}	10	OLM04.2-D/VOA	50	1	8021B ^N	10	OLM04.2-D/VOA	0.1	502.2 ⁴
			5	8260B ^E				5	8260B			0.1	524.2 ⁴
Chloroform <i>synonym:</i> <i>Trichloromethane</i>	67-66-3	590	25	8021B ^N	10	OLM04.2-D/VOA	100	0.2	8021B ^N	10	OLM04.2-D/VOA	0.02	502.2 ⁴
			5	8260B ^E				5	8260B			0.03	524.2 ⁴
2-Chlorophenol	95-57-8	750	660	8270C ^E	330	OLM04.2-D/SVOA	38	10	8270C	10	OLM04.2-D/VOA	3.3	625 ⁷
			210	8041 ^{E,M}				3.1	8041			0.58	604 ⁷
Total Chromium ^T	7440-47-3	38,000	500	6010B ^G	1000 ^C	ILM04.0/200.7 CLP-M	100	10	6010B	10	ILM04.0/200.7 CLP-M	4	200.7 ⁵
			400	6020A ^{1b,G}				0.9	6020			0.9	200.8 ⁵
Chromium III (<i>trivalent</i>) ^S	16065-83-1	10,000,000	Calculate as difference: Total - hexavalent = tri (or use:) 80 6020-SIM ^S		---	---	2,000	Calculate as difference: Total - hexavalent=tri (or use:) 0.08 6020-SIM ^S		---	---	Calculate as difference: Total - hexavalent=tri (or use:) 0.2 1639 ⁸ 0.9 200.8-SIM ⁵	
Chromium VI (<i>hexavalent</i>) ^S	18540-29-9	38,000	Alkaline Digestion (Method 3060A) + one of the following: 20000 7196A ^G 12 7199 ^G 80 6020A-SIM ^S		---	---	100	Alkaline Preservation + one of the following 5 7195 10 7198 0.3 7199 0.08 6020A-SIM ^S		---	---	Alkaline Preservation (See Method 1669) ⁸ + 10 218.4 ⁹ 5 218.5 ⁹ 0.4 218.6 ¹⁰ 0.5 1636 ⁸	
Chrysene	218-01-9	25,000	660	8270C	330	OLM04.2-D/SVOA	1.6	1.5	8310	10	OLM04.2-D/SVOA	0.3	525.2 ⁴
			1500	8310 ^N									
Copper	7440-50-8	580,000	400	6010B ^G	2500 ^C	ILM04.0/200.7 CLP-M	1,300	3	6010B	25	ILM04.0/200.7 CLP-M	3	200.7 ⁵
			200	6020A ^{1b,G}				0.5	6020			0.5	200.8 ⁵
Cyanide, free	57-12-5	150,000	1000	9014 (<i>free</i>)	2500 ^C	ILM04.0/335.2 CLP-M (<i>total CN-</i>)		20	9014 (<i>free</i>)	10	ILM04.0/335.2 CLP-M (<i>total CN-</i>) ^Y	5	335.4 ^{6,Y}
			2500	9213 (<i>free</i>)				50	9213 (<i>free</i>)				(<i>total CN-</i>)
4,4'-DDD (<i>DDD</i>)	72-54-8	28,000	500	8081B ^M	3.3	OLM04.2-D/PEST	3.5	0.50	8081B ^M	0.10	OLM04.2-D/PEST	0.01	508 ⁴

RESIDENTIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC (September 15, 2000)

Analyte	CAS No.	RESIDENTIAL SOIL (µg/kg)					RESIDENTIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQL	Method	CR(Q/D)L	Method		EQL	Method	CR(Q/D)L	Method	MDL	Method
4,4'-DDE (<i>DDE</i>)	72-55-9	20,000	580	8081B ^M	3.3	OLM04.2-D/PEST	2.5	0.58	8081B ^M	0.10	OLM04.2-D/PEST	0.02	508 ⁴
4,4'-DDT (<i>DDT</i>)	50-29-3	20,000	810	8081B ^M	3.3	OLM04.2-D/PEST	2.5	0.81	8081B ^M	0.10	OLM04.2-D/PEST	0.06	508 ⁴
Dibenz[a,h]anthracene	53-70-3	500	20	8310 ^{E,N}	330	OLM04.2-D/SVOA	0.12	0.03 ^F	8310	10	OLM04.2-D/SVOA	0.1	525.2 ⁴
Di-n-butyl phthalate	84-74-2	2,000,000	3300	8061A ^{N,R} 660 8270C	330	OLM04.2-D/SVOA	3,700	3.3	8061A 10 8270C	10	OLM04.2-D/SVOA	4	525.2 ⁴
1,2-Dichlorobenzene	95-50-1	17,000	0.5	8021B ^N 5 8260B	10	OLM04.2-D/VOA	600	2.7	8121 5 8260B	10	OLM04.2-D/SVOA	0.04 0.05	502.2 ⁴ 524.2 ⁴
1,3-Dichlorobenzene	541-73-1	130	0.2	8021B ^N 5 8260B ^E	10	OLM04.2-D/VOA	6.9	2.5	8121 5 8260B	10	OLM04.2-D/SVOA	0.07 0.05	502.2 ⁴ 524.2 ⁴
1,4-Dichlorobenzene	106-46-7	2,200	0.1	8021B ^N 5 8260B	10	OLM04.2-D/VOA	75	8.9	8121 5 8260B	10	OLM04.2-D/SVOA	0.04 0.04	502.2 ⁴ 524.2 ⁴
3,3'-Dichlorobenzidine	91-94-1	62	62	1625C ^{O,8}	330	OLM04.2-D/SVOA	1.9	1.4 ^F	8325	10	OLM04.2-D/SVOA	0.13	605 ⁷
1,1-Dichloroethane	75-34-3	5,600	0.7	8021B ^N 5 8260B	10	OLM04.2-D/VOA	990	0.7	8021B ^N 5 8260B	10	OLM04.2-D/VOA	0.03 0.04	502.2 ⁴ 524.2 ⁴
1,2-Dichloroethane	107-06-2	24	0.3	8021B ^{E,N} 5 8260B ^E	10	OLM04.2-D/VOA	5.0	0.3	8021B ^N 5 8260B	10	OLM04.2-D/VOA	0.03 0.06	502.2 ⁴ 524.2 ⁴
1,1-Dichloroethylene <i>synonym: 1,1-Dichloroethene</i>	75-35-4	58	0.7	8021B ^{E,N} 5 8260B ^E	10	OLM04.2-D/VOA	7.0	0.7	8021B ^N 5 8260B	10	OLM04.2-D/VOA	0.04 0.12	502.2 ⁴ 524.2 ⁴
cis-1,2-Dichloroethene <i>syn.: cis-1,2-Dichloroethylene</i>	156-59-2	400	0.2	8021B ^N 5 8260B ^E	10	OLM04.2-D/VOA	70	0.2	8021B ^N 5 8260B	10	OLM04.2-D/VOA	0.05 0.12	502.2 ⁴ 524.2 ⁴
trans-1,2-Dichloroethene <i>syn.: trans-1,2-Dichloroethylene</i>	156-60-5	680	0.5	8021B ^N 5 8260B ^E	10	OLM04.2-D/VOA	100	0.5	8021B ^N 5 8260B	10	OLM04.2-D/VOA	0.05 0.06	502.2 ⁴ 524.2 ⁴
2,4-Dichlorophenol	120-83-2	1,100	660 260	8270C ^E 8041 ^{E,N}	330	OLM04.2-D/SVOA	110	10 3.9	8270C 8041	10	OLM04.2-D/SVOA	0.39 2.7	604 ⁷ 625 ⁷
1,2-Dichloropropane	78-87-5	30	0.06	8021B ^N 5 8260B ^E	10	OLM04.2-D/VOA	5.0	0.06	8021B ^N 1 8260B ^D	10	OLM04.2-D/VOA	0.03 0.04	502.2 ⁴ 524.2 ⁴

RESIDENTIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC (September 15, 2000)

Analyte	CAS No.	RESIDENTIAL SOIL (µg/kg)					RESIDENTIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQL	Method	CR(Q/D)L	Method		EQL	Method	CR(Q/D)L	Method	MDL	Method
1,3-Dichloropropene (cis- and trans-)	542-75-6	40	0.3 5	8021B ^{E,N} 8260B ^E	10	OLM04.2-D/VOA	5.6	0.3 1	8021B ^N 8260B ^D	10	OLM04.2-D/VOA	0.1 0.1	502.2 ⁴ 524.2 ⁴
Dieldrin	60-57-1	46	30	8081B ^{E,M}	3.3	OLM04.2-PEST	0.053	0.044	8081B ^{F,M}	0.10	OLM04.2-PEST	0.02	508 ⁴
Diethylphthalate	84-66-2	450,000	660 2500	8270C 8061A ^{N,R}	330	OLM04.2-D/SVOA	29,000	10 2.5	8270C 8061A	10	OLM04.2-D/SVOA	0.8	525.2 ⁴
Dimethylphthalate	131-11-3	1,400,000	660 6400	8270C 8061A ^{N,R}	330	OLM04.2-D/SVOA	370,000	10 6.4	8270C 8061A	10	OLM04.2-D/SVOA	0.14 1.1	525.2 ⁴ 506 ⁴
2,4-Dimethylphenol	105-67-9	9,000	660 220	8270C 8041 ^{E,M}	330	OLM04.2-D/SVOA	730	10 3.2	8270C 8041	10	OLM04.2-D/SVOA	2.4	625 ⁷
Dimethylphthalate	131-11-3	1,400,000	660 6400	8270C 8061A ^{N,R}	330	OLM04.2-D/SVOA	370,000	10 6.4	8270C 8061A	10	OLM04.2-D/SVOA	1.1	506
2,4-Dinitrophenol	51-28-5	290	13	8041 ^F	830	OLM04.2-D/SVOA	73	50	8270C ^V	25	OLM04.2-D/SVOA	42	625 ⁷
Dinitrotoluene mixture	25321-14-6	8.5	1	8410 ^L	330	OLM04.2-D/SVOA	1.3	0.31	8330	10	OLM04.2-D/SVOA	0.02	609 ⁷
Di-n-octyl phthalate	117-84-0	2,000,000	660 490	8270C 8061A ^{N,R}	330	OLM04.2-D/SVOA	20	10 0.5	8270C 8061A	10	OLM04.2-D/SVOA	2.5	625 ⁷
Endosulfan	115-29-7	20,000	400	8081B ^M	3.3	OLM04.2-D/PEST	220	0.4	8081B ^M	0.10	OLM04.2-PEST	0.015	508 ⁴
Endrin	72-20-8	990	390	8081B ^M	3.3	OLM04.2-D/PEST	2.0	0.39	8081B ^M	0.10	OLM04.2-PEST	0.015	508 ⁴
Ethylbenzene	100-41-4	13,000	5 0.05	8260B 8021B ^N	10	OLM04.2-D/VOA	700	5 0.05	8260B 8021B ^N	10	OLM04.2-D/VOA	0.002 0.06	503.1 ⁴ 524.2 ⁴
Fluoranthene	206-44-0	880,000	660 2100	8270C 8310 ^N	330	OLM04.2-D/SVOA	210	10 2.1	8270C 8310	10	OLM04.2-D/SVOA	0.21 2.2	610 ⁷ 625 ⁷
Fluorene	86-73-7	170,000	660 2,100	8270C 8310 ^N	330	OLM04.2-D/SVOA	310	10 2.1	8270C 8310	10	OLM04.2-D/SVOA	0.21 1.9	610 ⁷ 625 ⁷
Heptachlor	76-44-8	540	27	8081B ^{E,M}	1.7	OLM04.2-D/PEST	0.40	0.40	8081B ^M	0.050	OLM04.2-D/PEST	0.01	508 ⁴
Heptachlor epoxide	1024-57-3	470	21	8081B ^{E,M}	1.7	OLM04.2-D/PEST	0.20	0.032	8081B ^{F,M}	0.050	OLM04.2-D/PEST	0.015	508 ⁴

RESIDENTIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC (September 15, 2000)

Analyte	CAS No.	RESIDENTIAL SOIL (µg/kg)					RESIDENTIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQL	Method	CR(Q/D)L	Method		EQL	Method	CR(Q/D)L	Method		
Hexachlorobenzene	118-74-1	2,200	660	8270C ^E 56 8121 ^{N,R}	330	OLM04.2-D/SVOA	1.0	0.056	8121 ^N	10	OLM04.2-D/SVOA	0.1	525.2 ⁴
Hexachloro-1,3-butadiene	87-68-3	16,000	660	8270C 14 8121 ^{N,R}	330	OLM04.2-D/SVOA	7.3	0.014	8121 ^N	10	OLM04.2-D/SVOA	0.05 0.11	502.2 ⁴ 524.2 ⁴
α-HCH (α-BHC)	319-84-6	7.2	1.9	8081B ^{F,M} 7.4 8121 ^{E,N}	1.7	OLM04.2-D/PEST	0.14	0.04	8081B ^F 0.11 8121 ^N	0.050	OLM04.2-D/PEST	0.025	508 ⁴
β-HCH (β-BHC)	319-85-7	26	15	8081B ^{E,M} 21 8121 ^{E,N}	1.7	OLM04.2-D/PEST	0.47	0.23	8081B ^M 0.31 8121 ^N	0.050	OLM04.2-D/PEST	0.01	508 ⁴
γ-HCH (γ-BHC) synonym: Lindane	58-89-9	9.4	2	8081B ^{F,M} 15 8121 ^{E,N}	1.7	OLM04.2-D/PEST	0.20	0.02	8081B ^F 0.2 8121 ^N	0.050	OLM04.2-D/PEST	0.015	508 ⁴
Hexachlorocyclopentadiene	77-47-4	400,000	660	8270C 2400 8121 ^{N,R}	330	OLM04.2-D/SVOA	50	10	8270C 2.4 8121 ^N	10	OLM04.2-D/SVOA	0.1	525.2 ⁴
Hexachloroethane	67-72-1	2,800	660	8270C ^E 16 8121 ^N	330	OLM04.2-D/SVOA	37	10	8270C 0.016 8121 ^N	10	OLM04.2-D/SVOA	0.03	612 ⁷
Indeno[1,2,3-cd]pyrene	193-39-5	3,100	660	8270C ^E 29 8310 ^N	330	OLM04.2-D/SVOA	0.022	0.043	8310 ^{F,X}	10	OLM04.2-D/SVOA	0.02	525.2 ⁴
Isophorone	78-59-1	5,300	660	8270C ^E	330	OLM04.2-D/SVOA	900	10	8270C	10	OLM04.2-D/SVOA	2.2	625 ⁷
Lead	7439-92-1	81,000	2800	6010B ^G 300 6020A ^{Ib,G}	4200 ^C	ILM04.0/200.7 CLP-M	15	1	7421 0.6 6020	3	ILM04.0/200.7 CLP-M	10 0.6	200.7 ⁵ 200.8 ⁵
Mercury	7439-97-6	2,100	200	7470/1A ^G 200 6020A ^{Ib,G}	200 ^C	ILM04.0/245.5 CLP-M	2.0	0.2	7470 0.1 7472	0.2	ILM04.0/245.1 or 245.2 CLP-M	0.2	245.1 ⁶
Methoxychlor	72-43-5	160,000	120	8081B ^M	17	OLM04.2-D/PEST	40	0.9	8081B ^M	0.50	OLM04.2-D/PEST	0.05	508 ⁴
Methyl bromide synonym: Bromomethane	74-83-9	52	11	8021B ^{E,N} 5 8260B ^E	10	OLM04.2-D/VOA	11	5	8260B 11 8021B ^N	10	OLM04.2-D/VOA	0.19 0.11	502.2 ⁴ 524.2 ⁴
Methylene chloride	75-09-2	23	0.2	8021B ^{E,N} 5 8260B ^E	10	OLM04.2-D/VOA	5.0	0.2	8021B ^N 5 8260B	10	OLM04.2-D/VOA	0.01 0.03	502.2 ⁴ 524.2 ⁴
Methyl ethyl ketone (MEK) synonym: 2-Butanone	78-93-3	12,000	2700	8015B ^Q 50 8260B ^K	10	OLM04.2-D/VOA	2,500	500	8015B ^{K,N} 50 8260B ^K	10	OLM04.2-D/VOA	0.48 50	524.2 ⁴ 1624C ⁸

RESIDENTIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC (September 15, 2000)

Analyte	CAS No.	RESIDENTIAL SOIL (µg/kg)					RESIDENTIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQL	Method	CR(Q/D)L	Method		EQL	Method	CR(Q/D)L	Method	MDL	Method
4-Methyl-2-pentanone (MIBK) <i>synonym: Methyl isobutyl ketone</i>	108-10-1	990	200 50	8015B ^{K,N} 8260B ^{E,K}	10	OLM04.2-D/VOA	210	200 50	8015B ^{K,N} 8260B ^{E,K}	10	OLM04.2-D/VOA	0.09 50 ^H	524.2 ⁴ 1624C ⁸
2-Methylphenol <i>synonym: o-Cresol</i>	95-48-7	14,000	660 220	8270C 8041 ^{H,M}	330	OLM04.2-D/SVOA	1,800	10 3.2	8270C 8041 ^{H,M}	10	OLM04.2-D/SVOA	10 ^H	1625C ⁸
3-Methylphenol <i>synonym: m-Cresol</i>	108-39-4	11,000	660 220	8270C 8041 ^{H,M}	[330	OLM04.2-D/SVOA]	1,800	10 3.2	8270C 8041 ^{H,M}	[10	OLM04.2-D/SVOA] ^W	[10	1625C] ^W
4-Methylphenol <i>synonym: p-Cresol</i>	106-44-5	1,100	660 220	8270C ^E 8041 ^{H,M}	330	OLM04.2-D/SVOA	180	10 3.2	8270C 8041 ^{H,M}	10	OLM04.2-D/SVOA	10 ^H	1625C ⁸
Methyl-t-butyl ether (MTBE) <i>syn.: Methyl tertiary-butyl ether</i>	1634-04-4	350	5	8260B ^E	10	OLM04.2-D/VOA	45	5	8260B	10	OLM04.2-D/VOA	1.2	524.2 ⁴
Naphthalene	91-20-3	700	5 660	8260B 8270C ^E	330	OLM04.2-D/SVOA	8.3	5 0.6	8260B 8021B ^{E,N}	10	OLM04.2-D/SVOA	0.04 1.6	524.2 ⁴ 625 ⁷
Nickel	7440-02-0	130,000	1000 200	6010B ^G 6020A ^{1b,G}	4000 ^C	ILM04.0/200.7 CLP-M	100	10 0.5	6010B ^G 6020A ^{1b,G}	40	ILM04.0/200.7 CLP-M	5 0.5	200.7 ⁵ 200.8 ⁵
2-Nitroaniline	88-74-4	41	2	8410 ^L	830	OLM04.2-D/SVOA	2.1	1.0	8131 ^F	25	OLM04.2-D/SVOA	10	1625C
Nitrobenzene	98-95-3	120	1.3	8410 ^L	330	OLM04.2-D/SVOA	18	6.4	8330	10	OLM04.2-D/SVOA	1.9	625 ⁷
N-Nitrosodiphenylamine	86-30-6	9,700	550 660	8070A ^{E,N} 8270C	330	OLM04.2-D/SVOA	170	8.1 10	8070A ^N 8270C	10	OLM04.2-D/SVOA	0.8 1.9	607 ⁷ 625 ⁷
N-Nitroso-di-n-propylamine	621-64-7	0.60	0.25	8410 ^L	330	OLM04.2-D/SVOA	0.12*	0.46	8070A ^{F,X}	10	OLM04.2-D/SVOA	0.46	607 ^{X,7}
Polychlorinated biphenyl compounds (PCBs)	1336-36-3	1,800	600	8082 ^M	67	OLM04.2-D/PEST	0.50	0.054 to 0.90 ^X 8082 ^{F,P} (as Aroclors)		1.0 to 2.0	OLM04.2-D/PEST	0.065 ₁₂₄₂ 0.15	608 ⁷ 1656
Pentachlorophenol	87-86-5	28	1.6 13	8151A ^Q _{GC/ECD} 8151A ^Q _{GC/MS}	830	OLM04.2-D/SVOA	1.0	0.76	8151A ^N	25	OLM04.2-D/SVOA	0.076	515.1 ⁴
Phenol	108-95-2	110,000	660	8270C	330	OLM04.2-D/SVOA	22,000	10	8270C	10	OLM04.2-D/SVOA	2.2	604 ⁷

RESIDENTIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC (September 15, 2000)

Analyte	CAS No.	RESIDENTIAL SOIL (µg/kg)					RESIDENTIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQL	Method	CR(Q/D)L	Method		EQL	Method	CR(Q/D)L	Method	MDL	Method
Pyrene	129-00-0	570,000	660 2700	8270C 8310	330	OLM04.2-D/SVOA	140	10 2.7	8270C 8310	10	OLM04.2-D/SVOA	0.16	525.2 ⁴
Selenium	7782-49-2	5,200	5000 3200	6010B ^G 6020A ^{1b,G}	500 ^C	ILM04.0/270.2 CLP-M (<i>furnace</i>)	50	2 8	7740 6020A	2	ILM04.0/270.2 CLP-M (<i>furnace</i>)	20 7.9	200.7 ⁵ 200.8 ⁵
Silver	7440-22-4	31,000	500 50	6010B ^G 6020A ^{1b,G}	1000 ^C	ILM04.0/200.7 CLP-M	180	10 60	6010B 7760A	10	ILM04.0/200.7 CLP-M	2 0.1	200.7 ⁵ 200.8 ⁵
Styrene	100-42-5	3,500	13 5	8021B ^N 8260B	10	OLM04.2-D/VOA	100	0.1 5	8021B ^N 8260B	10	OLM04.2-D/VOA	0.06	524.2 ⁴
1,1,1,2-Tetrachloroethane	630-20-6	50	6 5	8021B ^N 8260B ^E	---	---	6.9	0.05	8021B ^N	---	---	0.05	524.2 ⁴
1,1,2,2-Tetrachloroethane	79-34-5	7.0	0.1 5	8021B ^{E,N} 8260B ^E	10	OLM04.2-D/VOA	0.90	0.1	8021B ^N	10	OLM04.2-D/VOA	0.02 0.20	502.2 ⁴ 524.2 ⁴
Tetrachloroethylene (<i>PCE</i>) synonym: <i>Tetrachloroethene</i>	127-18-4	58	0.5 5	8021B ^{E,N} 8260B ^E	10	OLM04.2-D/VOA	5.0	0.5 1	8021B ^N 8260B ^D	10	OLM04.2-D/VOA	0.02 0.14	502.2 ⁴ 524.2 ⁴
Thallium	7440-28-0	2,800	2700 100	6020A ^G 6010B ^{1b,G}	500 ^C	ILM04.0/279.2 CLP-M (<i>furnace</i>)	2.0	0.3 1	6020A ^G 7841	1	ILM04.0/279.2 CLP-M (<i>furnace</i>)	0.3	200.8 ⁵
Toluene	108-88-3	12,000	13 5	8021B ^N 8260B	10	OLM04.2-D/VOA	1,000	0.1 5	8021B ^N 8260B	10	OLM04.2-D/VOA	0.11	524.2 ⁴
Toxaphene	8001-35-2	3,900	860	8081B ^{M,R}	170	OLM04.2-D/PEST	3.0	0.9	8081B ^M	5.0	OLM04.2-D/PEST	1.0	505 ⁴
1,2,4-Trichlorobenzene	120-82-1	5,300	38 5	8021B ^N 8260B	10	OLM04.2-D/VOA	70	0.3 5	8021B ^N 8260B	10	OLM04.2-D/SVOA	0.08 0.20	502.2 ⁴ 524.2 ⁴
1,1,1-Trichloroethane	71-55-6	1,900	38 5	8021B ^N 8260B	10	OLM04.2-D/VOA	200	0.3 5	8021B ^N 8260B	10	OLM04.2-D/VOA	0.01 0.08	502.2 ⁴ 524.2
1,1,2-Trichloroethane	79-00-5	30	0.5 5	8021B ^{E,H} 8260B ^E	10	OLM04.2-D/VOA	5.0	0.5 1	8021B ^{H,N} 8260B	10	OLM04.2-D/VOA	0.04 0.10	502.2 ⁴ 524.2 ⁴
Trichloroethylene (<i>TCE</i>) synonym: <i>Trichloroethene</i>	79-01-6	57	0.2 5	8021B ^{E,N} 8260B ^E	10	OLM04.2-D/VOA	5.0	0.2 1	8021B ^N 8260B ^D	10	OLM04.2-D/VOA	0.06 0.19	502.2 ⁴ 524.2 ⁴
2,4,5-Trichlorophenol	95-95-4	250,000	660 430	8270C 8041 ^{H,M}	830	OLM04.2-D/SVOA	3,700	10 6.4	8270C 8041	25	OLM04.2-D/SVOA	10	1625C ⁸
2,4,6-Trichlorophenol	88-06-2	1,500	660 430	8270C ^E 8041 ^M	330	OLM04.2-D/SVOA	77	10 6.4	8270C 8041	10	OLM04.2-D/SVOA	2.7	625 ⁷

RESIDENTIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC (September 15, 2000)

Analyte	CAS No.	RESIDENTIAL SOIL (µg/kg)					RESIDENTIAL GROUND WATER (µg/L)							
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²		
	EQL		Method	CR(Q/D)L	Method	EQL		Method	CR(Q/D)L	Method	MDL	Method		
Vinyl acetate	108-05-4	2,300	5	8260B	—	—	550	5	8260B	---	---	10	1624C ^{8,H}	
Vinyl chloride	75-01-4	13	5	8260B ^E	10	OLM04.2-D/VOA	2.0	1	8260B ^D	10	OLM04.2-D/VOA	0.18	502.2 ⁴	
			0.2	8021B ^{E,N}				0.2	8021B ^N			0.17	524.2 ⁴	
Xylene mixture (<i>o</i> -, <i>m</i> -, <i>p</i> -)	1330-20-7	190,000	5	8260B	10	OLM04.2-D/VOA	10,000	0.2	8021B ^N	10	OLM04.2-D/VOA	0.02	502.2 ⁴	
			25	8021B ^N				5	8260B			0.11	524.2 ⁴	
Zinc	7440-66-6	10,000,000	200	6010B ^G	2000 ^C	ILM04.0/200.7	CLP-M	11,000	2	6010B ^G	20	ILM04.0/200.7	2	200.7 ⁵
			700	6020A ^{1b,G}								1.8	200.8 ⁵	

NOTES
Table Information

10 OLM04.2-D/VOA

Shaded cell with light print indicates quantitation limit exceeds Default Closure Level. Method will not meet DQO without analytical modification.

* Asterisk indicates that no standard EPA method is available with a detection or quantitation limit able to meet the Default Closure Level for that matrix without modification. For some methods, modifications to lower detection limits may be as simple as using a larger sample size, extra concentration of extracts, use of an alternate extraction method, or use of an alternate detector. Consult your laboratory and your IDEM chemist.

^a Default Closure Level for RESIDENTIAL soil in units of µg/kg.

^b Default Closure Level for RESIDENTIAL groundwater in units of µg/L.

^CThe CLP SOW does not list CRDLs for soil samples. Soil CRDLs have been estimated as follows. **Note: Detection limits will be higher for samples with dry weight < 100%.**

* **metals by ICP** - formula on page D-13 of ILM04.0 assuming 100% dry weight, 0.5 g sample size, 50 mL final volume of digestate, and the aqueous CRDL from page C-2 as the concentration in the digestate. If the estimated ICP detection limit on page D-25 exceeds the aqueous CRDL, the ICP detection limit is substituted as the concentration in digestate. If the calculation using the CRDL on page C-2 exceeds the RISC closure level and the ICP estimated detection limit on page D-25 is lower than the CRDL, the ICP detection limit is substituted for the concentration in the digestate.

* **metals when the ICP estimated detection limit will not meet the RISC closure level** - formula on page D-13 of ILM04.0 assuming 100% dry weight, 0.5 g sample size, 50 mL final volume of digestate, and the lowest concentration of the optimum range for the furnace method as the concentration in the digestate. (Notation *furnace* added after method number.)

* **mercury** - the formula on page D-59 of ILM04.0 assuming 100% dry weight, a 0.2 gram sample, 200 mL final volume after preparation, and the aqueous CRDL as the concentration read from the standard curve.

* **cyanide** - the formula on page D-76 of ILM04.0 assuming a 1 gram sample, 100% dry weight, and the aqueous CRDL as the concentration read from the standard curve.

^D EQL obtained by purging 25 mL aqueous sample instead of 5 mL aqueous sample. (See SW-846 Method 8260B, Table 3, page 8260B-35, December 1996.)

^E EQL or CRQL for **low level** soil procedure (required). Methods for semivolatile and nonvolatile compounds assume a Gel Permeation Chromatography (GPC) clean up of extract prior to analysis.

^FMethod Detection Limit (MDL) is listed rather than EQL.

^G SW-846 metals methods reference instrument detection limits (IDLs) instead of quantitation limits. Therefore, a detection limit is listed rather than an EQL.

For **6010B**: (1) Aqueous detection limits are taken from the IDL table on page 6010B-19. (2) Soil detection limits have been calculated using the equation on page 6020A-9, assuming a 1gram sample (dry weight), 100 mL as the final digestate volume, and the aqueous IDLs as the concentration in the digestate. All are rounded up to the next 100 µg/L or /kg.

For **6020A**: Method 6020A does not provide a table of IDLs. MDLs taken from the analogous EPA water method (200.8, Rev. 5.5) for the appropriate matrix are listed.

^H Compound is listed in the method, but no MDL is provided. The MDL is estimated based on compounds of similar properties for which the method does provide a MDL.

^I EQL or MDL for SW-846 method estimated by using MDL for analogous waste water method using same instrumentation. EQLs were calculated by multiplying the MDL by standard SW-846 EQL matrix factors: (a) 10 for ground water, (b) 10 for low level soils in volatile organics methods, and (c) 670 for low level soils with GPC cleanup in semivolatile and nonvolatile organics methods. The analogous waste water method for SW-846 Method 8111 is 611.

^J MCL for arsenic is scheduled to be changed to 5 µg/L (0.005 mg/L) from 50 µg/L (0.050 mg/L) on January 1, 2001.

^K EQL multiplied a factor of 10 above method default EQL for matrix because of poor purging efficiency.

NOTES, continued
Table Information, continued

- ^L Methods utilizing Fourier Transform-Infrared Spectroscopy (FT-IR) for detection reference identification limits instead of EQLs; therefore identification limit is listed instead of EQL. For soil and sediment samples the identification limit has been calculated from the aqueous identification limit listed in Table 1, page 8410-11, assuming a 10 gram sample, a 1mL final extract volume prior to drying, and 100% dry weight. For analytes with two identification limits listed, the value in parenthesis has been used.
- ^M EQLs for Methods 8081B (01/98) and 8082 (12/96) are calculated using 8081 (09/94) MDLs multiplied by 8081B or 8082 matrix factors. (No MDLs in Methods 8081B and 8082.) EQLs for Method 8041 (12/96) are calculated using MDLs and matrix factors from Method 8040A (07/92), an earlier form of the same method. (Method 8041 does not provide MDLs).
- ^N EQL calculated by multiplying aqueous MDL (µg/L) by matrix factors listed in the method. If no table of EQL matrix factors is provided in the method, the aqueous MDLs have been multiplied by the following standard SW-846 EQL matrix factors: (a) Volatile organics methods - (i)10 for ground water, (ii) 10 for low level soils, and (iii) 1250 for high level soils; (b) Semivolatile organics methods - (i) 10 for ground water, (ii) 670 for low level soils with GPC cleanup, and (iii)10,000 for high level soils.
- ^O No SW-846 method meets required detection limit for solid matrices. Method referenced is an EPA Office of Water sediment method.
- ^P EQL(or MDL) is taken from text in the Scope and Application and/or Method Performance section of the method. (No MDL or EQL listed in tables for compound.)
- ^Q EQL is calculated by multiplying MDL or EDL for solid matrix times 10.
- ^R EQL or CRQL listed is for the high level (SW-846) or medium level (CLP) soils procedure: **If analytes requiring the low level soil procedure are also contaminants of concern for the method in question, the low level procedure should be run instead.** If a sample contains a mixture of high concentration and low concentration contaminants of concern, the low level soil procedure should be used to quantitate the low concentration analytes and, as needed, dilutions analyzed to quantitate the high concentration analytes.
SW-846: For methods other than 8260 and 8270, the high level EQL is the aqueous MDL times the high level soils factor. For 8260 and 8270, the high level EQL is the EQL for low level soils multiplied by: (a) 125 for volatiles (8260), or (b) 7.5 for semivolatiles (8270).
CLP: The medium level CRQL is the medium soil value listed in OLM04.2, Exhibit C.
- ^S If speciated Chromium will be analyzed, a separate sample must be taken for hexavalent chromium analysis. Although ICP-MS in selective ion monitoring (SIM) mode should be able to distinguish between Cr(VI) and Cr(III), method development would be necessary at most laboratories (requiring much additional time and expense). Therefore, In most cases the easiest way to determine separate concentrations for hexavalent chromium and trivalent chromium will be to analyze for total chromium, do a special preparation and analysis for hexavalent chromium on a separate sample, and determine trivalent chromium by difference:
(1) For water samples, the sample for analysis of hexavalent chromium must be preserved with *sodium hydroxide*. **This will increase the holding time from 24 hours to 30 days.** (See EPA Method 1669, Section 8.4.5for instructions.) The sample to be analyzed for all other metals (except mercury), including total chromium (or trivalent, if a method is available) should be acid preserved.
b. For soil samples, the sample for hexavalent chromium must be digested by *Method 3060A*, and digestion must occur *within 30 days of sampling*. The sample to be analyzed for other metals can also be analyzed for total chromium (or trivalent chromium, if a method is available); this sample will undergo acid digestion, and the holding time is the usual six months
- ^T If only total chromium will be run (i.e., hexavalent and/or trivalent chromium will not be analyzed for specifically), the default closure levels for hexavalent chromium will apply.
- ^U Requires heated purge (80EC).
- ^V The EQL listed for this analyte in Method 8270C is higher than the default 10µg/L (water) and 660 µg/kg (soil).
- ^W [EQL Method No.] Analyte is not explicitly listed in method but is amenable to analysis by method. Analyte was listed in a previous version of the method, or analytes with similar properties are listed for the method.
- ^X EQL or MDL exceeds closure level but is in within an order of magnitude. Method may be acceptable for use without modification. Consult the IDEM project chemist.

Notes continued

Table information Continued

^Y Includes measurement of complexed cyanides. The CLP SOW and the EPA water methods do not include methods specifically for free cyanide. Measurement of total cyanide may lead to artificially high results.

NOTES, continued

References: Methods Manuals

^{1a}*Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, USEPA Publication SW-846, Third edition, Final Update III, [NTIS#: PB97-156111 (integrated 3rd edition through Update III)], June 1997 (***unless otherwise noted***).

^{1b}*Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, USEPA Publication SW-846, Third edition, Update IVA: Notice of Data Availability (NODA), published in the Federal Register on May 8, 1998 (63 FR 25430).

²*USEPA Contract Laboragory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration*, OLM04.2, [EPA web site: <http://www.epa.gov/superfund/programs/clp/methods.htm>], August 1994

³*USEPA Contract Laboragory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration*, ILM04.0, [NTIS#: PB95-963545], July 1995

⁴*Methods for the Determination of Organic Compounds in Drinking Water - Supplement III*, EPA/600/R-95/131, August 1995

⁵*Methods for the Determination of Metals in Environmental Samples*, EPA/600/4-91/010, June 1991

⁶*Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA/600/R-93/100, August 1993

⁷Code of Federal Regulations, 40 CFR 136 - Revised as of July 1, 1995, Appendix A to Part 136 - "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater"

⁸Stand Alone Method (EPA Office of Water method that is not part of a compendium). Referenced from CD-ROM, "EPA Methods and Guidance for Analysis of Water" (1999), prepared for the USEPA Office of Water by DynCorp Consulting Services Division under EPA Contract 68-C3-0337.

⁹*Methods for Chemical Analysis of Water and Wastes (MCAWW)* EPA/600/4-79-020 - Revised March 1983

¹⁰*Methods for the Determination of Metals in Environmental Samples - Supplement I* - EPA/600/R-94-111- May 1994

¹¹*Methods for the Determination of Nonconventional Pesticides in Municipal and Industrial Wastewater - Vol.I* - EPA-821-R-93-010-A August 1993, Revision 1

¹²*Analytical Methods for the Determination of Pollutants in Pharmaceutical Manufacturing Industry Wastewater, Revision A*, EPA-821-B-98-016 - July 1998

INDUSTRIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC

Analyte	CAS No.	INDUSTRIAL SOIL (µg/kg)					INDUSTRIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQL	Method	CR(Q/D)	L		Method	EQL	Method	CR(Q/D)	L	Method
Acenaphthene	83-32-9	1,200,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	4,200	10	8270C	10	OLM04.2-D/SVOA	1.9	625 ⁷
Acetone <i>synonym: 2-Propanone</i>	67-64-1	41,000	625 20000	8260B ^R 8015B ^{N,R}	1200	OLM04.2-D/VOA ^R	10,000	50 160	8260B ^K 8015B ^N	10	OLM04.2-D/VOA	50	1624C ⁸
Acrolein <i>synonym: 2-Propenal</i>	107-02-8	220	50	8260B ^{E,K}	—	---	2,000	5	8260B	—	—	50	1624C ⁸
Aldrin	309-00-2	800	340	8081B ^{M,R}	1.7	OLM04.2-D/PEST	0.17	0.034	8081B ^F	0.050	OLM04.2-D/PEST	0.007 0.045	505 ⁴ 525.2 ⁴
Anthracene	120-12-7	51,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	43	10	8270C	10	OLM04.2-D/VOA	0.18	525.2 ⁴
Antimony	7440-36-0	37,000	2100	6010B ^G	3200 ^C	ILM04.0/200.7 CLP-M	41	3 21	7041 (7010 ^{1b}) 6010B ^G	3	ILM04.0/204.2 CLP-M <i>(furnace)</i>	3 8	204.2 ⁵ 200.7 ⁵
Arsenic	7440-38-2	20,000	3500	6010B ^G	5300 ^C	ILM04.0/200.7 CLP-M	50	1 1.4	7060A(7010 ^{1b}) 6020A ^{1b,G}	1	ILM04.0/206.2 CLP-M <i>(furnace)</i>	1 8	206.2 ⁵ 200.7 ⁵
Barium	7440-39-3	5,900,000	100	6010B ^G	20000 ^C	ILM04.0/200.7 CLP-M	7,200	1	6010B ^G	200	ILM04.0/200.7 CLP-M	1 0.8	200.7 ⁵ 200.8 ⁵
Benz[a]anthracene	56-55-3	15,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	3.9	0.13	8310	10	OLM04.2-D/SVOA	0.20	525.2 ⁴
Benzene	71-43-2	670	5	8260B ^E	10	OLM04.2-D/VOA ^E	99	5	8260B	10	OLM04.2-D/VOA	0.02 0.04	502.2 ⁴ 524.2 ⁴
Benzo[b]fluoranthene	205-99-2	15,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	1.5	0.18	8310	10	OLM04.2-D/SVOA	0.3	525.2 ⁴
Benzo[k]fluoranthene	207-08-9	39,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	0.80	0.17	8310	10	OLM04.2-D/SVOA	0.3	525.2 ⁴
Benzoic acid	65-85-0	1,600,000	25000	8270C ^{R,V}	—	—	410,000	50	8270C ^V	—	—	50 ^H	1625C ⁸
Benzo[a]pyrene	50-32-8	1,500	660	8270C ^E	330	OLM04.2-D/SVOA ^E	0.39	0.23	8310	10	OLM04.2-D/SVOA	0.1	525.2 ⁴
Benzyl alcohol	100-51-6	140,000	9800	8270C ^{R,V}	—	—	31,000	20	8270C ^V	—	—	50 ^H	1625C ⁸
Beryllium	7440-41-7	2,300,000	200	6010B ^G	500 ^C	ILM04.0/200.7 CLP-M	200	0.2	6010B ^G	5	ILM04.0/200.7 CLP-M	0.7 0.3	200.7 ⁵ 200.8 ⁵
Bis(2-chloroethyl)ether <i>syn: 1,1'-Oxybis(2-chloroethane)</i>	111-44-4	12	3.5	8410 ^L	330	OLM04.2-D/SVOA	2.6	3	8111 ^{1,X}	10	OLM04.2-D/SVOA	0.3	611 ⁷

INDUSTRIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC

Analyte	CAS No.	INDUSTRIAL SOIL (µg/kg)					INDUSTRIAL GROUND WATER (µg/L)							
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²		
			EQLMethod		CR(Q/D)LMethod			EQL	Method	CR(Q/D)L	Method	MDL	Method	
Bis(2-chloroisopropyl)ether <i>syn.: 2,2'-Oxybis(1-chloropropane)</i>	108-60-1	260	2.5	8410 ^L	330	OLM04.2-D/SVOA	41	8	8111B ¹ 25 8410 ^L	10	OLM04.2-D/SVOA	0.8	611 ⁷	
Bis(2-ethylhexyl)phthalate <i>syn.: Di(2-ethylhexyl)phthalate</i>	117-81-7	980,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	200	2.7	8061A	10	OLM04.2-D/SVOA	0.8	525.2 ⁴	
Bromodichloromethane	75-27-4	630	5	8260B ^E	10	OLM04.2-D/VOA ^E	100	5	8260B	10	OLM04.2-D/VOA	0.08	524.2 ⁴	
Bromoform <i>synonym: Tribromomethane</i>	75-25-2	2,700	625	8260B ^R	1200	OLM04.2-D/VOA ^R	360	5	8260B	10	OLM04.2-D/VOA	0.12	524.2 ⁴	
n-Butanol <i>syn.: n-butyl alcohol, 1-butanol</i>	71-36-3	44,000	625 9400	8260B ^{R,U} 8015B ^U	---	---	10,000	5 140	8260B 8015B ^N	---	---	500	1666 ¹²	
Butyl benzyl phthalate	85-68-7	930,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	2,700	10	8270C	10	OLM04.2-D/SVOA	0.5	525.2 ⁴	
Cadmium	7440-43-9	77,000	300	6010B ^G	500 ^C	ILM04.0/200.7 CLP-M	51	0.1 5	7131A 6020A	5	ILM04.0/200.7 CLP-M	1 0.5	200.7 ⁵ 200.8 ⁵	
Carbazole	86-74-8	20,000	[5000 [1000	8270C ^{R,W} 8275A ^{P,W}	10000	OLM04.2-D/SVOA ^R	140	[10	8270C]	330	OLM04.2-D/SVOA	20	1625C ⁸	
Carbon disulfide	75-15-0	82,000	625	8260B ^R	1200	OLM04.2-D/VOA ^R	10,000	5	8260B	10	OLM04.2-D/VOA	0.09	524.2 ⁴	
Carbon tetrachloride	56-23-5	290	5 13	8260B ^E 8021B ^N	10	OLM04.2-D/VOA ^E	22	1 0.1	8260B ^D 8021B ^N	10	OLM04.2-D/VOA	0.01 0.21	502.2 ⁴ 524.2 ⁴	
Chlordane	57-74-9	39,000	370 (()	8081B ^{M,R}	1.7	OLM04.2-D/PEST	0.082	0.37(()	8081B ^M	0.05	OLM04.2-D/PEST	0.0015	508 ⁴	
p-Chloroaniline <i>synonym: 4-Chloroaniline</i>	106-47-8	2,700	440 1300	8131 ^{E,N} 8270C ^{E,V}	330	OLM04.2-D/SVOA ^E	410	46 20	8131 8270C	10	OLM04.2-D/SVOA	20	1625C ⁸	
Chlorobenzene	108-90-7	27,000	625	8260B ^R	1200	OLM04.2-D/VOA ^R	2,000	5	8260B	10	OLM04.2-D/VOA	0.04	524.2 ⁴	
Chloroethane	75-00-3	5,200	625	8260B ^R	1200	OLM04.2-D/VOA ^R	990	5	8260B	10	OLM04.2-D/VOA	0.1	524.2 ⁴	
Chloroform <i>synonym: Trichloromethane</i>	67-66-3	1,200	625	8260B ^R	10	OLM04.2-D/VOA ^E	470	5	8260B	10	OLM04.2-D/VOA	0.03	524.2 ⁴	
2-Chlorophenol	95-57-8	10,000	5000	8270C ^R	330	OLM04.2-D/SVOA ^E	510	10	8270C	10	OLM04.2-D/VOA	3.3	625 ⁷	
Total Chromium ^T	7440-47-3	38,000	500	6010B ^G	1000 ^C	ILM04.0/200.7 CLP-M	100	10	6010B	10	ILM04.0/200.7 CLP-M	4	200.7 ⁵	

INDUSTRIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC

Analyte	CAS No.	INDUSTRIAL SOIL (µg/kg)					INDUSTRIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQLMethod		CR(Q/D)LMethod			EQL	Method	CR(Q/D)L	Method	MDL	Method
Chromium III (<i>trivalent</i>) ^S	16065-83-1	10,000,000	<i>Calculate as difference: Total - hexavalent = tri (or use:) 80 6020-SIM^S</i>		--- —		150,000	<i>Calculate as difference: Total - hexavalent = tri (or use:) 0.08 6020-SIM^S</i>		--- —		<i>Calculate as difference: Total - hexavalent = tri (or use:) 0.2 1639⁸ 0.9 200.8-SIM⁵</i>	
Chromium VI (<i>hexavalent</i>) ^S	18540-29-9	38,000	Alkaline Digestion (Method 3060A) <i>plus one of:</i> 20000 7196A 12 7199 80 6020-SIM ^S		--- ---		100	Alkaline Preservation (See Method 1669⁸) <i>plus one of:</i> 5 7195 10 7198 0.3 7199 0.08 6020-SIM ^S		--- ---		Alkaline Preservation (See Method 1669⁸) <i>plus one of:</i> 10 218.4 ⁹ 5 218.5 ⁹ 0.4 218.6 ¹⁰ 0.5 1636 ⁸	
Chrysene	218-01-9	25,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	1.6	1.5	8310	10	OLM04.2-D/SVOA	0.3	525.2 ⁴
Copper	7440-50-8	1,700,000	400	6010B ^G	2500 ^C	ILM04.0/200.7 CLP-M	3,800	3	6010B	25	ILM04.0/200.7 CLP-M	3	200.7 ⁵
Cyanide, free	57-12-5	410,000	1000 2500	9014 (<i>free</i>) 9213 (<i>free</i>)	2500 ^C	ILM04.0/335.2 CLP-M (total CN-) ^Y	2,000	20 50	9014 (<i>free</i>) 9213 (<i>free</i>)	10	ILM04.0/335.2 CLP-M (total CN-) ^Y	5	335.4 ⁶ (total CN-) ^Y
4,4'-DDD (<i>DDD</i>)	72-54-8	120,000	500	8081B ^{M,R}	3.3	OLM04.2-D/PEST	12	0.50	8081B ^M	0.10	OLM04.2-D/PEST	0.01	508 ⁴
4,4'-DDE (<i>DDE</i>)	72-55-9	86,000	580	8081B ^{M,R}	3.3	OLM04.2-D/PEST	8.4	0.58	8081B ^M	0.10	OLM04.2-D/PEST	0.02	508 ⁴
4,4'-DDT (<i>DDT</i>)	50-29-3	86,000	810	8081B ^{M,R}	3.3	OLM04.2-D/PEST	8.4	0.81	8081B ^M	0.10	OLM04.2-D/PEST	0.06	508 ⁴
Dibenz[a,h]anthracene	53-70-3	1,500	660	8270C ^E	330	OLM04.2-D/SVOA ^E	0.39	0.03 ^F	8310	10	OLM04.2-D/SVOA	0.1	525.2 ⁴
Di-n-butyl phthalate	84-74-2	2,000,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	10,000	10	8270C	10	OLM04.2-D/SVOA	4	525.2 ⁴
1,2-Dichlorobenzene	95-50-1	270,000	625	8260B ^R	1200	OLM04.2-D/VOA ^R	9,200	5	8260B	10	OLM04.2-D/SVOA	0.05	524.2 ⁴
1,3-Dichlorobenzene	541-73-1	1,800	625	8260B ^R	1200	OLM04.2-D/VOA ^R	92	5	8260B	10	OLM04.2-D/SVOA	0.05	524.2 ⁴
1,4-Dichlorobenzene	106-46-7	3,400	625	8260B ^R	1200	OLM04.2-D/VOA ^R	120	5	8260B	10	OLM04.2-D/SVOA	0.04	524.2 ⁴

INDUSTRIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC

Analyte	CAS No.	INDUSTRIAL SOIL (µg/kg)					INDUSTRIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQLMethod		CR(Q/D)LMethod			EQL	Method	CR(Q/D)L	Method	MDL	Method
3,3'-Dichlorobenzidine	91-94-1	210	62	1625C ^{O,8}	330	OLM04.2-D/SVOA	6.4	1.4 ^F	8325	10	OLM04.2-D/SVOA	0.13	605 ⁷
1,1-Dichloroethane	75-34-3	58,000	625	8260B ^R	1200	OLM04.2-D/VOA ^R	10,000	5	8260B	10	OLM04.2-D/VOA	0.04	524.2 ⁴
1,2-Dichloroethane	107-06-2	150	5	8260B ^E	10	OLM04.2-D/VOA ^E	31	5	8260B	10	OLM04.2-D/VOA	0.06	524.2 ⁴
1,1-Dichloroethylene <i>synonym: 1,1-Dichloroethene</i>	75-35-4	58	0.7 5	8021B ^{E,N} 8260B ^E	10	OLM04.2-D/VOA ^E	7.0	0.7 5	8021B ^N 8260B	10	OLM04.2-D/VOA	0.12	524.2 ⁴
cis-1,2-Dichoroethene <i>syn.: cis-1,2-Dichloroethylene</i>	156-59-2	5,800	625	8260B ^R	1200	OLM04.2-D/VOA ^R	1,000	5	8260B	10	OLM04.2-D/VOA	0.12	524.2 ⁴
trans-1,2-Dichoroethene <i>syn.: trans-1,2-Dichloroethylene</i>	156-60-5	14,000	625	8260B ^R	1200	OLM04.2-D/VOA ^R	2,000	5	8260B	10	OLM04.2-D/VOA	0.06	524.2 ⁴
2,4-Dichlorophenol	120-83-2	3,000	660	8270C ^E	330	OLM04.2-D/SVOA ^E	310	10	8270C	10	OLM04.2-D/SVOA	2.7	625 ⁷
1,2-Dichloropropane	78-87-5	250	5	8260B ^E	10	OLM04.2-D/VOA ^E	42	5	8260B	10	OLM04.2-D/VOA	0.04	524.2 ⁴
1,3-Dichloropropene (cis- and trans-)	542-75-6	200	5	8260B ^E	10	OLM04.2-D/VOA ^E	29	5	8260B	10	OLM04.2-D/VOA	0.1	524.2 ⁴
Dieldrin	60-57-1	150	30	8081B ^{E,M}	3.3	OLM04.2-PEST	0.18	0.044	8081B ^{F,M}	0.10	OLM04.2-PEST	0.02	508 ⁴
Diethylphthalate	84-66-2	1,300,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	82,000	10	8270C	10	OLM04.2-D/SVOA	0.8	525.2 ⁴
Dimethylphthalate	131-11-3	1,400,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	1,000,000	10	8270C	10	OLM04.2-D/SVOA	0.14	525.2 ⁴
2,4-Dimethylphenol	105-67-9	25,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	2,000	10	8270C	10	OLM04.2-D/SVOA	2.4	625 ⁷
2,4-Dinitrophenol	51-28-5	820	220 3300	8041 ^M 8270C ^V	830	OLM04.2-D/SVOA ^{E,X}	200	50	8270C ^V	25	OLM04.2-D/SVOA	42	625 ⁷
Dinitrotoluene mixture	25321-14-6	28	1 ^L	8410	330	OLM04.2-D/SVOA	4.2	0.31	8330	10	OLM04.2-D/SVOA	0.02	609 ⁷
Di-n-octyl phthalate	117-84-0	2,000,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	20	10	8270C	10	OLM04.2-D/SVOA	2.5	625 ⁷
Endosulfan	115-29-7	46,000	400	8081B ^M	3.3	OLM04.2-D/PEST	510	0.4	8081B ^M	0.10	OLM04.2-PEST	0.015	508 ⁴
Endrin	72-20-8	15,000	390	8081B ^M	3.3	OLM04.2-D/PEST	31	0.39	8081B ^M	0.10	OLM04.2-PEST	0.015	508 ⁴

INDUSTRIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC

Analyte	CAS No.	INDUSTRIAL SOIL (µg/kg)					INDUSTRIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQLMethod		CR(Q/D)LMethod			EQL	Method	CR(Q/D)L	Method	MDL	Method
Ethylbenzene	100-41-4	200,000	625	8260B ^R	1200	OLM04.2-D/VOA ^R	10,000	5	8260B	10	OLM04.2-D/VOA	0.06	524.2 ⁴
Fluoranthene	206-44-0	880,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	210	10	8270C	10	OLM04.2-D/SVOA	2.2	625 ⁷
Fluorene	86-73-7	1,100,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	2,000	10	8270C	10	OLM04.2-D/SVOA	1.9	625 ⁷
Heptachlor	76-44-8	1,200	400	8081B ^{M,R}	1.7	OLM04.2-D/PEST	0.64	0.40	8081B ^M	0.050	OLM04.2-D/PEST	0.01	508 ⁴
Heptachlor epoxide	1024-57-3	1,000	320	8081B ^{M,R}	1.7	OLM04.2-D/PEST	0.31	0.3	8081B ^M	0.050	OLM04.2-D/PEST	0.015	508 ⁴
Hexachlorobenzene	118-74-1	3,900	660	8270C ^E	330	OLM04.2-D/SVOA ^E	1.8	0.056	8121 ^N	10	OLM04.2-D/SVOA	0.1	525.2 ⁴
Hexachloro-1,3-butadiene	87-68-3	44,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	20	10	8270C	10	OLM04.2-D/SVOA	0.9	625 ⁷
∑-HCH (∑-BHC)	319-84-6	24	23	8081B ^{E,M}	1.7	OLM04.2-D/PEST	0.45	0.35	8081B ^M	0.050	OLM04.2-D/PEST	0.025	508 ⁴
∑-HCH (∑-BHC)	319-85-7	86	15	8081B ^{E,M}	1.7	OLM04.2-D/PEST	1.6	0.23	8081B ^M	0.050	OLM04.2-D/PEST	0.01	508 ⁴
(-)-HCH ((-)-BHC) synonym: Lindane	58-89-9	100	17	8081B ^{E,M}	1.7	OLM04.2-D/PEST	2.2	0.25	8081B ^M	0.050	OLM04.2-D/PEST	0.015	508 ⁴
Hexachlorocyclopentadiene	77-47-4	2,000,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	720	10	8270C	10	OLM04.2-D/SVOA	0.1	525.2 ⁴
Hexachloroethane	67-72-1	7,700	5000	8270C ^R	330	OLM04.2-D/SVOA ^E	100	10	8270C	10	OLM04.2-D/SVOA	0.03	612 ⁷
Indeno[1,2,3-cd]pyrene	193-39-5	3,100	660	8270C ^E	330	OLM04.2-D/SVOA ^E	0.022	0.043	8310 ^{F,X}	10	OLM04.2-D/SVOA	0.02	525.2 ⁴
Isophorone	78-59-1	18,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	3,000	10	8270C	10	OLM04.2-D/SVOA	2.2	625 ⁷
Lead	7439-92-1	230,000	2800	6010B ^G	4200 ^C	ILM04.0/200.7 CLP-M	42	1 28	7421 6010B ^G	3	ILM04.0/200.7 CLP-M	10	200.7 ⁵
Mercury	7439-97-6	32,000	2000 200	6010B ^G 7471A	200 ^C	ILM04.0/245.5 CLP-M	31	0.2 0.2	7470 6020A ^{1b,G}	0.2	ILM04.0/245.1 or 245.2 CLP-M	0.2	245.1 ⁶
Methoxychlor	72-43-5	180,000	860	8081B ^M	17	OLM04.2-D/PEST	45	0.9	8081B ^M	0.50	OLM04.2-D/PEST	0.05	508 ⁴

INDUSTRIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC

Analyte	CAS No.	INDUSTRIAL SOIL (µg/kg)					INDUSTRIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQL	Method	CR(Q/D)	LMethod		EQL	Method	CR(Q/D)	LMethod	MDL	Method
Methyl bromide <i>synonym: Bromomethane</i>	74-83-9	700	5	8260B ^E	10	OLM04.2-D/VOA ^E	140	5	8260B	10	OLM04.2-D/VOA	0.11	524.2 ⁴
Methylene chloride	75-09-2	1,800	625	8260B ^R	1200	OLM04.2-D/VOA ^R	380	5	8260B	10	OLM04.2-D/VOA	0.03	524.2 ⁴
Methyl ethyl ketone (MEK) <i>synonym: 2-Butanone</i>	78-93-3	260,000	6250	8260B ^{R,K}	1200	OLM04.2-D/VOA ^R	61,000	50	8260B ^K	10	OLM04.2-D/VOA	0.28	524.2 ⁴
4-Methyl-2-pentanone(MIBK) <i>syn.: Methyl isobutyl ketone</i>	108-10-1	39,000	6250	8260B ^{R,K}	1200	OLM04.2-D/VOA ^R	8,200	50	8260B ^K	10	OLM04.2-D/VOA	0.09	524.2 ⁴
2-Methylphenol <i>synonym: o-Cresol</i>	95-48-7	39,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	5,100	10	8270C	10	OLM04.2-D/SVOA	10 ^H	1625C ⁸
3-Methylphenol <i>synonym: m-Cresol</i>	108-39-4	30,000	5000	8270C ^R	[10000	OLM04.2-D/SVOA ^R]	5,100	10	8270C	[10	OLM04.2-D/SVOA] ^W	[10	1625C ⁸] ^W
4-Methylphenol <i>synonym: p-Cresol</i>	106-44-5	3,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	510	10	8270C	10	OLM04.2-D/SVOA	10 ^H	1625C ⁸
Methyl-t-butyl ether (MTBE) <i>syn.: Methyl tertiary-butyl ether</i>	1634-04-4	5,600	625	8260B ^R	1200	OLM04.2-D/VOA ^R	720	5	8260B	10	OLM04.2-D/VOA	1.2	524.2 ⁴
Naphthalene	91-20-3	170,000	625 5000	8260B ^R 8270C ^R	10000	OLM04.2-D/SVOA ^R	2,000	5 10	8260B 8270	10	OLM04.2-D/SVOA	1.6	625 ⁷
Nickel	7440-02-0	2,700,000	1000	6010B ^G	4000 ^C	ILM04.0/200.7 CLP-M	2,000	10	6010B ^G	40	ILM04.0/200.7 CLP-M	5	200.7 ⁵
2-Nitroaniline	88-74-4	110	2	8410 ^L	830	OLM04.2-D/SVOA	5.8	1	8131 ^F	25	OLM04.2-D/SVOA	10	1625C ⁸
Nitrobenzene	98-95-3	340	260	8330 ^Q	330	OLM04.2-D/SVOA	51	6.4	8330	10	OLM04.2-D/SVOA	1.9	625 ⁷
N-Nitrosodiphenylamine	86-30-6	32,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	580	10	8270C	10	OLM04.2-D/SVOA	1.9	625 ⁷
N-Nitroso-di-n-propylamine	621-64-7	2.0	0.25	8410 ^L	330	OLM04.2-D/SVOA	0.41*	0.46	8070A ^X	10	OLM04.2-D/SVOA	0.46	607 ^{X,7}
Polychlorinated biphenyl compounds (PCBs)	1336-36-3	5,300	600 660	8082 ^M 8270C ^E	67	OLM04.2-D/PEST	1.4	0.90	8082 ^M	1.0 to 2.0 ^X	OLM04.2-D/PEST	0.065 ₁₂₄₂ 0.15	608 ⁷ 1656
Pentachlorophenol	87-86-5	660	51 3300	8151A ^N 8270C ^V	830	OLM04.2-D/SVOA	24	0.76 50	8151A ^N 8270C ^V	25	OLM04.2-D/SVOA	3.6	625 ⁷
Phenol	108-95-2	320,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	61,000	10	8270C	10	OLM04.2-D/SVOA	3.0	625 ⁷
Pyrene	129-00-0	570,000	5000	8270C ^R	10000	OLM04.2-D/SVOA ^R	140	10	8270C	10	OLM04.2-D/SVOA	1.9	625 ⁷

INDUSTRIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC

Analyte	CAS No.	INDUSTRIAL SOIL (µg/kg)					INDUSTRIAL GROUND WATER (µg/L)							
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²		
			EQLMethod		CR(Q/D)LMethod			EQL	Method	CR(Q/D)L	Method	MDL	Method	
Selenium	7782-49-2	53,000	5000	6010B ^G	7500 ^C	ILM04.0/200.7 CLP-M	510	50	6010B ^G	75	ILM04.0/200.7 CLP-M	20	200.7 ⁵	
Silver	7440-22-4	87,000	500	6010B ^G	1000 ^C	ILM04.0/200.7 CLP-M	510	5	6010B ^G	10	ILM04.0/200.7 CLP-M	2	200.7 ⁵	
Styrene	100-42-5	720,000	625	8260B ^R	1200	OLM04.2-D/VOA ^R	20,000	5	8260B	10	OLM04.2-D/VOA	0.06	524.2 ⁴	
1,1,1,2-Tetrachloroethane	630-20-6	790	5	8260B	---	---	110	5	8260B	---	---	0.05	524.2 ⁴	
1,1,2,2-Tetrachloroethane	79-34-5	110	5	8260B ^E	10	OLM04.2-D/VOA ^E	14	5	8260B	10	OLM04.2-D/VOA	6.9	624 ⁷	
Tetrachloroethylene (PCE) synonym: Tetrachloroethene	127-18-4	640	5	8260B ^E	10	OLM04.2-D/VOA ^E	55	5	8260B	10	OLM04.2-D/VOA	4.1	624 ⁷	
Thallium	7440-28-0	13,000	2700	6010B ^G	4000 ^C	ILM04.0/200.7 CLP-M	9.2	0.3 1	6020A ^{1b,G} 7841	1	ILM04.0/279.2 CLP-M (furnace)	1	200.7 ⁵	
Toluene	108-88-3	240,000	625	8260B ^R	1200	OLM04.2-D/VOA ^R	20,000	5	8260B	10	OLM04.2-D/VOA	6.0	624 ⁷	
Toxaphene	8001-35-2	12,000	860	8081B ^{M,R}	170	OLM04.2-D/PEST	3.0	0.9	8081B ^M	5.0	OLM04.2-D/PEST	1.0	505 ⁴	
1,2,4-Trichlorobenzene	120-82-1	77,000	625	8260B ^R	1200	OLM04.2-D/VOA ^R	1,000	5	8260B	10	OLM04.2-D/VOA	1.9	625 ⁷	
1,1,1-Trichloroethane	71-55-6	35,000	625	8260B ^R	1200	OLM04.2-D/VOA ^R	3,600	5	8260B	10	OLM04.2-D/VOA	3.8	624 ⁷	
1,1,2-Trichloroethane	79-00-5	300	5	8260B ^E	10	OLM04.2-D/VOA ^E	50	5	8260B	10	OLM04.2-D/VOA	5.0	624 ⁷	
Trichloroethylene (TCE) synonym: Trichloroethene	79-01-6	3,000	625	8260B ^R	1200	OLM04.2-D/VOA ^R	260	5	8260B	10	OLM04.2-D/VOA	1.9	624 ⁷	
2,4,5-Trichlorophenol	95-95-4	690,000	5000	8270C ^R	25000	OLM04.2-D/SVOA ^R	10,000	10 6.4	8270C 8041	25	OLM04.2-D/SVOA	---	---	
2,4,6-Trichlorophenol	88-06-2	5,000	660	8270C ^E	10000	OLM04.2-D/SVOA ^R	260	10 6.4	8270C 8041	10	OLM04.2-D/SVOA	2.7	625 ⁷	
Vinyl acetate	108-05-4	430,000	625	8260B ^R	---	---	100,000	5	8260B	---	---	10	1624C ^{8,H}	
Vinyl chloride	75-01-4	13	5 0.2	8260B ^E 8021B ^{E,N}	10	OLM04.2-D/VOA ^E	2.0	1 0.2	8260B ^D 8021B ^N	10	OLM04.2-D/VOA	0.18 0.17	502.2 ⁴ 524.2 ⁴	

INDUSTRIAL CLOSURE - ANALYTICAL METHODS WITH REPORTING LIMITS FOR RISC													
Analyte	CAS No.	INDUSTRIAL SOIL (µg/kg)					INDUSTRIAL GROUND WATER (µg/L)						
		Default Closure Level ^a , µg/kg	SW-846 ^{1a}		CLP ^{2,3}		Default Closure Level ^b , µg/L	SW-846 ^{1a}		CLP ^{2,3}		EPA Drinking & Waste Water ⁴⁻¹²	
			EQLMethod	CR(Q/D)LMMethod	EQL	Method		CR(Q/D)L	Method	MDL	Method		
Xylene mixture (o-, m-, p-)	1330-20-7	410,000	625	8260B ^R	1200	OLM04.2-D/VOA ^R	180,000	5	8260B	10	OLM04.2-D/VOA	0.11	524.2 ⁴
Zinc	7440-66-6	10,000,000	200	6010B	2000 ^C	ILM04.0/200.7 CLP-M	31,000	2	6010B	20	ILM04.0/200.7 CLP-M	2	200.7 ⁵

NOTES
Table Information

10 OLM04.2-D/VOA

Shaded cell with light print indicates quantitation limit exceeds Default Closure Level. Method will not meet DQO without analytical modification.

- * Asterisk indicates that no standard EPA method is available with a detection or quantitation limit able to meet the Default Closure Level for that matrix without modification. For some methods, modifications to lower detection limits may be as simple as using a larger sample size, extra concentration of extracts, use of an alternate extraction method, or use of an alternate detector. Consult your laboratory and your IDEM chemist.
- ^a Default Closure Level for RESIDENTIAL soil in units of µg/kg.
- ^b Default Closure Level for RESIDENTIAL groundwater in units of µg/L.
- ^C The CLP SOW does not list CRDLs for soil samples. Soil CRDLs have been estimated as follows. **Note: Detection limits will be higher for samples with dry weight < 100%.**
 *metals by ICP - formula on page D-13 of ILM04.0 assuming 100% dry weight, 0.5 g sample size, 50 mL final volume of digestate, and the aqueous CRDL from page C-2 as the concentration in the digestate. If the estimated ICP detection limit on page D-25 exceeds the aqueous CRDL, the ICP detection limit is substituted as the concentration in digestate. If the calculation using the CRDL on page C-2 exceeds the RISC closure level and the ICP estimated detection limit on page D-25 is lower than the CRDL, the ICP detection limit is substituted for the concentration in the digestate.
 *metals when the ICP estimated detection limit will not meet the RISC closure level - formula on page D-13 of ILM04.0 assuming 100% dry weight, 0.5 g sample size, 50 mL final volume of digestate, and the lowest concentration of the optimum range for the furnace method as the concentration in the digestate. (Notation *furnace* added after method number.)
 *mercury - the formula on page D-59 of ILM04.0 assuming 100% dry weight, a 0.2 gram sample, 200 mL final volume after preparation, and the aqueous CRDL as the concentration read from the standard curve.
 *cyanide - the formula on page D-76 of ILM04.0 assuming a 1 gram sample, 100% dry weight, and the aqueous CRDL as the concentration read from the standard curve.
- ^D EQL obtained by purging 25 mL aqueous sample instead of 5 mL aqueous sample. (See SW-846 Method 8260B, Table 3, page 8260B-35, December 1996.)
- ^E EQL or CRQL for **low level** soil procedure (required). Methods for semivolatile and nonvolatile compounds assume a Gel Permeation Chromatography (GPC) clean up of extract prior to analysis.
- ^F Method Detection Limit (MDL) is listed rather than EQL.
- ^G SW-846 metals methods reference instrument detection limits (IDLs) instead of quantitation limits. Therefore, a detection limit is listed rather than an EQL. For Method 6010B, detection limits were determined as follows: (1) Aqueous detection limits are taken from the IDL table on page 6010B-19. (2) Soil detection limits have been calculated using the equation on page 6020A-9, assuming a 1gram sample (dry weight), 100 mL as the final digestate volume, and the aqueous IDL as the concentration in the digestate. All are rounded to the nearest 100 µg/L or µg/kg. Method 6020A may be run instead of Method 6010B.
- ^H Compound is listed in the method, but no MDL is provided. The MDL is estimated based on compounds of similar properties for which the method does provide a MDL.
- ^I EQL or MDL for SW-846 method estimated by using MDL for analogous waste water method using same instrumentation. EQLs were calculated by multiplying the MDL by standard SW-846 EQL matrix factors: (a) 10 for ground water, (b) 10 for low level soils in volatile organics methods, and (c) 670 for low level soils with GPC cleanup in semivolatile and nonvolatile organics methods. The analogous waste water method for SW-846 Method 8111 is 611.
- ^J MCL for arsenic is scheduled to be changed to 5 µg/L (0.005 mg/L) from 50 µg/L (0.050 mg/L) on January 1, 2001.
- ^K EQL multiplied a factor of 10 above method default EQL for matrix because of poor purging efficiency.
- ^L Methods utilizing Fourier Transform-Infrared Spectroscopy (FT-IR) for detection reference identification limits instead of EQLs; therefore identification limit is listed instead of EQL. For soil and sediment samples the identification limit has been calculated from the aqueous identification limit listed in Table 1, page 8410-11, assuming a 10 gram sample, a 1mL final extract volume prior to drying, and 100% dry weight. For analytes with two identification limits listed, the value in parenthesis has been used.

Notes Continued
Table Information Continued

- ^M EQLs for Methods 8081B (01/98) and 8082 (12/96) are calculated using 8081 (09/94) MDLs multiplied by 8081B or 8082 matrix factors. (No MDLs in Methods 8081B and 8082.). EQLs for Method 8041 (12/96) are calculated using MDLs and matrix factors from Method 8040A (07/92), an earlier form of the same method. (Method 8041 does not provide MDLs).
- ^N EQL calculated by multiplying aqueous MDL (µg/L) by matrix factors listed in the method. If no table of EQL matrix factors is provided in the method, the aqueous MDLs have been multiplied by the following standard SW-846 EQL matrix factors: (a) Volatile organics methods - (i) 10 for ground water, (ii) 10 for low level soils, and (iii) 1250 for high level soils; (b) Semivolatile organics methods - (i) 10 for ground water, (ii) 670 for low level soils with GPC cleanup, and (iii) 10,000 for high level soils.
- ^O No SW-846 method meets required detection limit for solid matrices. Method referenced is an EPA Office of Water sediment method.
- ^P EQL is taken from text in the Scope and Application and/or Method Performance section of the method. (No MDL or EQL listed in tables for compound.)
- ^Q EQL is calculated by multiplying MDL or EDL for solid matrix times 10.
- ^R EQL or CRQL listed is for the high level (SW-846) or medium level (CLP) soils procedure: **If analytes requiring the low level soil procedure are also contaminants of concern for the method in question, the low level procedure should be run instead.** If a sample contains a mixture of high concentration and low concentration contaminants of concern, the low level soil procedure should be used to quantitate the low concentration analytes and, as needed, dilutions analyzed to quantitate the high concentration analytes.
SW-846: For methods other than 8260 and 8270, the high level EQL is the aqueous MDL times the high level soils factor. For 8260 and 8270, the high level EQL is the EQL for low level soils multiplied by: (a) 125 for volatiles (8260), or (b) 7.5 for semivolatiles (8270).
CLP: The medium level CRQL is the medium soil value listed in OLM04.2, Exhibit C.
- ^S If speciated Chromium will be analyzed, a separate sample must be taken for hexavalent chromium analysis. Although ICP-MS in selective ion monitoring (SIM) mode should be able to distinguish between Cr(VI) and Cr(III), method development would be necessary at most laboratories (requiring much additional time and expense). Therefore, In most cases the easiest way to determine separate concentrations for hexavalent chromium and trivalent chromium will be to analyze for total chromium, do a special preparation and analysis for hexavalent chromium on a separate sample, and determine trivalent chromium by difference:
(1) For water samples, the sample for analysis of hexavalent chromium must be preserved with *sodium hydroxide*. **This will increase the holding time from 24 hours to 30 days.** (See EPA Method 1669, Section 8.4.5 for instructions.) The sample to be analyzed for all other metals (except mercury), including total chromium (or trivalent, if a method is available) should be acid preserved.
b. For soil samples, the sample for hexavalent chromium must be digested by *Method 3060A*, and digestion must occur *within 30 days of sampling*. The sample to be analyzed for other metals can also be analyzed for total chromium (or trivalent chromium, if a method is available); this sample will undergo acid digestion, and the holding time is the usual six months
- ^T If only total chromium will be run (i.e., hexavalent and/or trivalent chromium will not be analyzed for specifically), the default closure levels for hexavalent chromium will apply.
- ^U Requires heated purge (80EC).
- ^V The EQL listed for this analyte in Method 8270C is higher than the default 10 µg/L (water) and 660 µg/kg (soil).
- ^W [EQL Method No.] Analyte is not explicitly listed in method but is amenable to analysis by method. Analyte was listed in a previous version of the method, or analytes with similar properties are listed for the method.
- ^X EQL or MDL exceeds closure level but is within an order of magnitude. Method may be acceptable for use without modification. Consult the IDEM project chemist.
- ^Y Includes measurement of complexed cyanides. The CLP SOW and the EPA water methods do not include methods specifically for free cyanide. Measurement of total cyanide may lead to artificially high results.

NOTES, continued
References: Methods Manuals

^{1a}*Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, USEPA Publication SW-846, Third edition, Final Update III, [NTIS#: PB97-156111 (integrated 3rd edition through Update III)], June 1997 (***unless otherwise noted***).

^{1b}*Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, USEPA Publication SW-846, Third edition, Update IVA: Notice of Data Availability (NODA), published in the Federal Register on May 8, 1998 (63 FR 25430).

²*USEPA Contract Laboragory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration*, OLM04.2, [EPA web site: <http://www.epa.gov/superfund/programs/clp/methods.htm>], May 1999

³*USEPA Contract Laboragory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration*, ILM04.0, [NTIS#: PB95-963545], July 1995

⁴*Methods for the Determination of Organic Compounds in Drinking Water - Supplement III*, EPA/600/R-95/131, August 1995

⁵*Methods for the Determination of Metals in Environmental Samples*, EPA/600/4-91/010, June 1991

⁶*Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA/600/R-93/100, August 1993

⁷Code of Federal Regulations, 40 CFR 136 - Revised as of July 1, 1995, Appendix A to Part 136 - "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater"

⁸Stand Alone Method (EPA Office of Water method that is not part of a compendium). Referenced from CD-ROM, "EPA Methods and Guidance for Analysis of Water" (1999), prepared for the USEPA Office of Water by DynCorp Consulting Services Division under EPA Contract 68-C3-0337.

⁹*Methods for Chemical Analysis of Water and Wastes (MCAWW)* EPA/600/4-79-020 - Revised March 1983

¹⁰*Methods for the Determination of Metals in Environmental Samples - Supplement I* - EPA/600/R-94-111- May 1994

¹¹*Methods for the Determination of Nonconventional Pesticides in Municipal and Industrial Wastewater - Vol.I - Revision I*, EPA-821-R-93-010-A, August 1993

¹²*Analytical Methods for the Determination of Pollutants in Pharmaceutical Manufacturing Industry Wastewater, Revision A*, EPA-821-B-98-016 - July 1998